ATTITUDES, KNOWLEDGE, AND CONSUMPTION OF FRUITS

AND VEGETABLES BY COLLEGE STUDENTS

By

REBECCA S. PLATO

Bachelor of Science in Home Economics

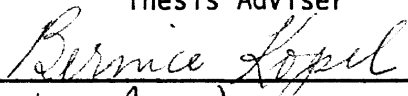University of Central Oklahoma

Edmond, Oklahoma

1991

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
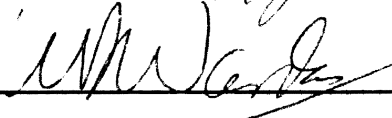the Degree of
MASTER OF SCIENCE
July, 1993

ATTITUDES, KNOWLEDGE, AND CONSUMPTION OF FRUITS
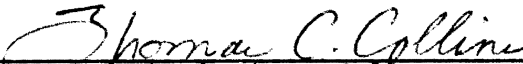
AND VEGETABLES BY COLLEGE STUDENTS

Thesis Approved:

_____
Thesis Adviser

_____

_____

_____
Dean of the Graduate College

ACKNOWLEDGMENTS

I would like to thank Dr. Lea Ebro, academic and thesis adviser, for her assistance, encouragement, and support while completing my graduate work. Also appreciated were the contributions from my other committee members, Dr. Bernice Kopel and Dr. William Warde. Their suggestions and assistance were invaluable. I would also like to thank Dr. Robert W. Huss, Director of Residential Life, for providing the photo copies of the research instrument and for facilitating the distribution of the questionnaires.

To my parents, Frank and Margaret Plato, I wish to dedicate this thesis. Their financial and moral support, made this accomplishment a reality. I would also like to thank my fiance, Phil Wilburn, for his patience and understanding during the completion of this study.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

"Nutrition is essential for sustenance, health, and well-being" (DHHS, 1991, p. 112). As consumers, we are aware that what we eat affects our health. Each day we obtain new knowledge to related substances such as fiber, fat, or cholesterol and how it affects our health. In addition, new evidence accumulates each day relating the occurrence of many diseases to our food consumption patterns. In fact, dietary factors are associated with five of the 10 leading causes of death: coronary heart disease, some types of cancer, stroke, noninsulin dependent diabetes mellitus, and atherosclerosis (DHHS, 1991). The once-prevalent nutrient deficiencies have been replaced by excess and imbalances of some food components in the diet. With these facts present, many health professionals now see health promotion as important as disease treatment (Axelson & Brinberg, 1987).

In a report published by the Office of Disease Prevention and Health Promotion, a division of the Department of Health and Human Services, improved nutrition is listed as one of the 21 identified strategies to improve the nation's health over this decade (DHHS, 1991). In particular, it places a high priority on improving nutrition practices to reflect the Dietary Guidelines for Americans (USDA, 1990). One of these objectives is to increase the fruit and vegetable consumption to at least five daily servings. Specifically, this would include at

least two to four servings of fruit and three to five servings of vegetables each day. In order to help our nation reach this goal, it is important that the attitudes about diet and nutrition and specifically the attitudes regarding consumption of fruits and vegetables, be closely measured and monitored.

Importantly, there are indicators of increased fruit and vegetable consumption (Loughrey, Doner, & Lurie, 1992); however, intake still remains below the recommended five daily servings (Patterson, Block, Rosenberger, Pee, & Kahle, 1990). Fortunately, the public has shown increasing interest to learn about nutrition, with positive response to recent nutrition-related media campaigns. As food and nutrition educators, we need to determine current fruit and vegetable consumption patterns and the variables involved in these patterns. This information allows for the development of more accurate and effective educational tools to help aid in knowledge and compliance of these new recommendations (Axelson & Brinberg, 1987).

Purpose and Objectives of the Study

The purpose of this study is to determine the types and the amounts of fruits and vegetables consumed by Oklahoma State resident hall students (to be referred to hereafter as college students) and to determine if there is an association between the college students' attitudes, the dietary guidelines, and consumption patterns.

The objectives of the study are to:

1. Identify the type and amounts of fruits and vegetables consumed by college students and compare these amounts to the current USDA Dietary Guidelines.

2.   Determine the impact or effects of attitudes among college students toward the consumption of fruits and vegetables.

3.   Relate selected personal variables with attitudes and consumption patterns.

Hypotheses

The following hypotheses will be examined:

1.   There will be no significant association between fruit and vegetable consumption patterns of college students and the selected personal variables: gender, race, age, education level, college, and meal plan.

2.   There will be no significant association between the fruit and vegetable consumption patterns of college students and their attitudes about fruits and vegetables toward health and nutrition, selection, and food safety.

3.   There will be no significant association between the college students' personal variables and their attitudes toward fruit and vegetable consumption.

4.   There will be no significant association between college students' personal variables and the USDA Dietary Guidelines of fruit and vegetable consumption.

Assumptions and Limitation

The assumptions of this research are:

1.   The students will honestly answer the questionnaire to the best of their ability.

2.   The students will be knowledgeable enough about their intake of fruit and vegetables to actually answer the questionnaire.

A major limitation in this study is that only a random sample of students (N=995) living in the resident halls at Oklahoma State University in the spring of 1993 are surveyed.

Definition of Terms

The following terms are defined so that the researcher's intent is specifically understood.

Attitude: "A reference to a person's feelings to and evaluation of some object, person, issue or event" (Fishbein & Ajzen, 1975, p. 12).

Drupe: A simple fleshy fruit in which a stone or pit encloses the seed, such as apricots, cherries, peaches, and plums (Bennion, 1990).

Fiber: "Plant material which is resistant to hydrolysis by the endogenous enzymes of the mammalian digestive tract" (Institute of Food Technology, 1989, p. 133).

Integrated Pest Management (IPM): An approach to pest control that uses the latest agricultural technologies, a range of farming techniques, and biological controls (e.g., pest predators and pest diseases) to decrease the need for pesticides (Chaisson, Peterson, & Douglass, 1991).

Organically Grown: Growers that do not use synthetic chemicals but rather use naturally occurring chemicals such as sulfur, nicotine, pyrethrins, and copper as an approach to pest control (Chaisson, Peterson, & Douglass, 1991).

Pesticide: Chemicals that kill, repel or retard the growth of pests (Chaisson, Peterson, & Douglass, 1991).

<u>USDA Dietary Guidelines</u>: Dietary guidelines for healthy Americans aged two years and older which reflect recommendations of nutrition authorities who agree that enough is known about diet's effect on health to encourage certain dietary practices (DHHS, 1991; USDA, 1990).

CHAPTER II

REVIEW OF LITERATURE

Introduction

This chapter will be devoted to a review of the literature per-
taining to food consumption patterns and other food related studies
previously reported. This study was undertaken to determine the
consumption of fruits and vegetables of a select group of college
students living in the residence halls of a land-grant state university.

Food Related Behavior

People can provide an abundance of information about their eating
patterns such as what foods they eat, why they eat certain foods and
avoid others, and when they eat certain foods. As results accumulate
linking many diseases to the foods we consume, more research and edu-
cation opportunities are created in the area of health promotion
(Axelson & Brinberg, 1987). As professionals in food and nutrition
and other health related fields, it is vital that we find ways to pro-
mote beneficial eating patterns in the general population. To address
the modification of food related behavior, we must first understand why
people eat what they eat. This can be accomplished by asking people
to tell us how they think, feel, and act in relation to the food they
eat and choose.

Many variables exist in food related behavior. Psychosocial variables include the internal state such as knowledge, beliefs, and attitudes. Sociodemographic variables reflect the individual's access to socially-mediated activities and are called external variables. Income, ethnicity, and age are examples of external variables (Axelson & Brinberg, 1987).

Food related behavior has been conceptualized in two general ways: 1) as a behavior, and 2) as an outcome behavior. Examples of behavioral measurements are food choices, food purchases, and types and amounts of foods consumed. An example of outcome of behavior would be nutrient intake (Axelson & Brinberg, 1987).

Researchers involved in food related behavior often hypothesize that if individuals increase their knowledge of nutrition and modify their beliefs and attitudes, the desirable changes in food related behavior will then result. Thus, a need is created for evidence of individuals' eating patterns (how they behave), their knowledge/belief (what they think), and their attitudes (what they feel) (Axelson & Brinberg, 1987).

Consumers understand that what they eat affects their health. It is necessary, however, that health professionals understand why we eat the foods that we do to help better understand how to develop and maintain dietary practices conducive to good health (Axelson & Brinberg, 1987).

Daily Fruit and Vegetable Recommendations

Dietary Guidelines for Americans

The Dietary Guidelines for Americans (USDA, 1990) provide Americans

aged two and older with information on healthy eating. These guidelines reflect recommendations of nutrition authorities who feel enough information is known about diet's effect on health to encourage certain dietary practices.

One of the Dietary Guidelines (Appendix B) states, "Choose a diet with plenty of vegetables, fruits, and grain products" (USDA, 1990, p. 18). Specifically, this guideline recommends that adults eat at least three servings of vegetables and two servings of fruits daily. It is important to remember that fruit and vegetable consumption helps us achieve a variety of foods in our diet.

Over the past several decades, concern about food consumption and health has shifted from disease of the undernourished to disease of affluence (Gormley, Downey, & O'Beirne, 1987). Diseases caused by vitamin and mineral deficiencies are now rare except for some nutrients such as calcium and iron (USDA, 1990). Generally, the American diet contains too much fat (especially saturated fat), cholesterol, and sodium. Also, diets contain too few calories from complex carbohydrates and fiber. Research has indicated that these diets are one cause of America's high rates of obesity and certain diseases. Research continues to pinpoint the exact role of diet in some of these diseases (Block, Pattern, & Subar, 1992; Horwath & Worsley, 1991; Nilsson, Sundell, Hellsten, & Hallmans, 1990; USDA, 1990).

The 5 A Day for Better Health Program

The 5 A Day for Better Health program is designed to address the goal of increasing the fruit and vegetable consumption among Americans to at least five daily servings (Loughrey, Doner, & Lurie, 1992). The

program is jointly sponsored by the National Cancer Institute and the Produce for Better Health Foundation. The aim is to make Americans more aware of how fruits and vegetables can improve their health, including how they may help lower their risk of getting cancer.

The Food Pyramid

Recently, the Basic Four Food Groups used for meal planning has been converted to the Food Guide Pyramid: A Guide to Daily Food Choices (Appendix C). The pyramid guide is an outline of what to eat each day. It calls for eating a variety of foods to get needed nutrients, but also focuses on eating the right amount of calories to maintain a healthy weight. It graphically shows the vegetable group (3-5 servings) and the fruit group (2-4 servings) as separate food groups. This will hopefully dissuade consumers from thinking that fruits and vegetables belong to one food group as in the Basic Four Food Groups configuration.

A report from the Office of Disease Prevention and Health Promotion (DHHS, 1991) contains a national strategy for significantly improving the health of the nation over the coming decade. It addresses the prevention of major chronic illness, injuries, and infectious disease. Improved nutrition is one of the 21 priorities identified in the report. It places high priority on improving nutrition practices to reflect the Dietary Guidelines for Americans. Several national health objectives in this report aim for specific measurable changes in dietary behaviors of Americans, as well as increased access to healthier food products by the year 2000. Encouraging healthy choices in diet, exercise, weight control, and other risk factors for disease is emphasized. Fruit and vegetable consumption is listed among the 21

specific objectives directed toward public health nutrition (Appendix D). The sixth objective in this report is to increase complex carbohydrate and fiber-containing foods in the diets of adults to five or more daily servings of vegetables (including legumes) and fruits and to six daily servings of grain products (USDA, 1991).

Chemical Composition

The primary composition of freshly harvested fruits and vegetables is water. The water content may range somewhere between 65 percent and 69 percent. Fruits and vegetables contain small amounts of protein, fat, and large amounts of carbohydrates. Also, they are rich in micronutrients which provide us with many good sources of vitamins and minerals. Fruits and vegetables also contain fiber, long chain carbohydrates called pectin, hemicellulose, or cellulose. Fruits and vegetables along with grains are the major supplier of dietary fiber (Shewfelt, 1990).

Food Safety

Recently the media has given much attention to the use of crop-protectant chemicals to enhance/maintain quality of fruits and vegetables. Attention has focused on the growth regulator daminozide (Alar) and its metabolites found in apples, and speculation of grapes imported with cyanide. Due to these scares brought on by the media and others, concern over food safety has risen (Shewfelt, 1990).

Pesticides in Food

Chaisson, Peterson, and Douglass (1991, p. 1) state "Most consumers

expect food to be safe, free of imperfections, nutritious, easy to store, easy to serve, and available at a low cost all year long." Thus, farmers and processors add pesticides to the food they produce to meet these criteria.

The pesticides used to protect fruit and vegetables in the field may remain in or on commodities at the time of harvest. It is also important to note, however, that damage to crops from insects and rodents that inoculate plants in the field with microorganisms can cause visual damage and present serious health hazards. This is especially true when vegetables are not washed and eaten raw. The problem may become further compounded when manure is used as a fertilizer which is a potent source of human pathogens (Shewfelt, 1990). Molds that are normally held in check by the use of fungicides produce mycotoxins which can cause potential danger. Also, plants under attack produce stress metabolites known as phytoalexins, which provide the plant with a natural defense. These phytoalexins can build up in the fruit or vegetable and become toxic to humans. It also has been discovered that harmful microorganisms such as Listeria can grow in fresh vegetables (Shewfelt, 1990).

With recent concern over pesticides, many alternatives to chemical pest control are under study. They, however, pose their own complication and dangers. For instance, genetic manipulation (cultivators resistant to pests) involves accumulation within the plant of chemicals toxic to the insect. Again, a problem arises because it is possible that these could also become toxic to humans. Another alternative to chemical control of pests is Integrated Pest Management (IPM). This type of management maintains pest damage below the economic threshold

with a minimal input of externally applied chemicals. It is becoming increasingly more popular (Shewfelt, 1990).

In addition to these alternatives, concern also lies in the area of decay and postharvest losses. Usually these are controlled by fungicidal spraying before the crop is harvested, or an application of a dip or wax packing before shipment. Alternatives in this area include hot water dipping and irradiation, yet both can cause physiological damage to the fruit or vegetable. Organic is another alternative which is loosely defined as minimal or no inputs from a synthetically derived agricultural chemical (Shewfelt, 1990). Organically grown fruits and vegetables have disadvantages such as unappealing appearance and dangers of natural toxins or natural pesticides (Chaisson, Peterson, & Douglass, 1991).

Overall, safety concerns have risen, but they still remain on the back burner as fruit and vegetable consumption continues to increase spurred by nutritional consideration of consumers (Loughrey, Doner, & Lurie, 1992). It is believed that naturally occurring toxins (including carcinogens) may be of more concern than the residues in foods resulting from applied pesticides (Ames & Magan, 1987). Most scientists agree that more risk comes from contamination of food with bacteria, viruses, and molds, which cause thousands of deaths each year (Chaisson, Peterson, & Douglass, 1991). Although foods can not be 100 percent safe, consumers may reduce their food-related risks if they choose food carefully, wash and peel produce and eat a variety of foods (Chaisson, Peterson, & Douglass, 1991).

Consumption Studies

The U.S. Department of Agriculture (USDA) and the National Center for Health Statistics regularly conduct surveys which provide information on dietary intake of the US population (Carrol, Abraham, & Dresser, 1983; CSFII, 1988; Human Nutrition Information Service, 1984). The National Health and Nutrition Examination Survey (NHANES), conducted twice by the National Center for Health Statistics (NHANES I, 1971-1975; NHANES II 1976-1980) is currently conducting NHANES III (1989-1994). This study measures consumption using 24-hour dietary recall by a brief frequency questionnaire. The NHANES III will use an extensive frequency questionnaire. The Nationwide Food Consumption Survey (NFCS 1978-1980 and 1987-1988) used a 24-hour dietary recall survey with an additional 2-day dietary record. USDA's continuing survey of Food Intakes of Individuals (CSP-II) was conducted in 1985 and 1986 and also used the 24-hour dietary recall method.

Data from the NHANES II

As stated previously, the National Health and Nutrition Examination Survey (NHANES II) was a well known survey conducted on a large number of individuals in the United States by the National Center for Health Statistics between 1976 and 1980. In this study the 24-hour dietary recall method was used to measure the number of servings of fruits and vegetables consumed by black and white adults, to examine the types of servings, and to estimate the mean intake of calories from fat, dietary fiber and Vitamins A and C by number of servings (Patterson, Block, Rosenberger, Pee, & Kahle, 1990). The results were that an estimated 45 percent of the population had no servings of fruit or fruit juice and

and 22 percent had no servings of a vegetable on recall day. In regard
to the USDA Dietary Guidelines, only 27 percent had consumed three or
more servings of vegetables, and only 29 percent had the two or more
servings of fruit. In addition, only 9 percent consumed both three or
more servings of vegetables and two or more servings of fruit. Other
pertinent data found in this survey included lower consumption rates
among black than whites, and lack of variety in vegetable consumption
among blacks. Although these data are more than 10 years old, recent
research has reported similar findings. This discrepancy between the
dietary guidelines and the actual diet suggest a need for more public
education (Patterson et al., 1990).

College Student Consumption Data

Many studies have focused on various aspects of student con-
sumption patterns, however, no study has been specific to only
measuring fruit and vegetable consumption and the attitudes and
knowledge affecting consumption patterns. In one previous study,
consumption patterns of students living on campus, off campus, and
in the Greek housing were measured (Beerman, Jennings, & Crawford,
1990). The findings suggested that differences between residence and
sex may have influenced food consumption and dietary practices of the
students. When fruit and vegetable consumption was measured from the
food frequency survey, the results indicated that students (31%)
living off campus were less likely to consume fruits and vegetables
as compared to students (55%) residing in dormitories and students (56%)
living in Greek housing. When asked about skipping meals, this study
found that students in Greek housing were less likely to skip meals.

Another study conducted on 1226 college students measured the knowledge of dietary and exercise related behavior (Melby, Femea, & Sciacca, 1986). The results reported that 43 percent of the students failed to eat any vegetables on a daily basis, and 69 percent failed to eat any fruit on a daily basis. These findings occurred despite the fact that 95 percent reported that a healthy diet would include eating servings of fruits and vegetables each day. In addition, results indicated that daily fruit (25%) and vegetable (51%) consumption was lower among those students living off campus when compared to daily fruit (37%) and vegetable (51%) consumption of those living in the residence halls.

An article titled "What Some College Students Eat" reported that the general adolescent lifestyle is one of skipping regular meals and eating snacks (Marrale, Shipman, & Rhodes, 1986). When reviewing the participants' current eating practices, 49 percent reported eating two meals per day while 36 percent reported eating three meals per day. Over 70 percent of the subjects reported having two snacks per day while all subjects admitted having snacks. From the 24-hour recall diary, greater than 25 percent of the subjects achieved a rating of "good" while greater than 75 percent rated as "fair" or "poor" on their diary of food intake over a 24-hour period. The study concluded that "adequate nutrition, for the most part, is non-existent in this very active pressure-laden group of young adults" (Marrale, Shipman, & Rhodes, 1986, p. 20).

Another study of college students' food consumption patterns compared nutrient intakes, and food selected among subgroups divided by energy intake (Hernon, Skinner, Andrews, & Penfield, 1986). It was found that women consuming < 1,200 kcal had lower intakes of protein, carbohydrates, fat, calcium, iron, thiamin, riboflavin, and niacin;

they ate less frequently; and they ate less meat, eggs, legumes, bread, cooked starchy vegetables, milk products, desserts, added fat, and added sugar when compared with men and women consuming > 1,200 kcals. Those consuming < 1,200 did eat more nutrient dense food, however they did not meet the RDAs for calcium, iron, thiamin, riboflavin and niacin. This data was analyzed from a 3-day food record and a demographic questionnaire with height and weight. With 28 percent of the reporting subjects eating < 1,200 kcal, results may indicate a need for nutrition education in the population subgroup (Hernon et al., 1986).

Data from Fresh Trends

Consumers' consumption patterns, and the changes in them, can be measured by asking consumers how much they are eating. These results can show some interesting trends. Every year The Packer Focus, a produce industry trade publication, conducts a survey of fresh fruit and vegetable consumption ("Fresh Trends," 1992). From the 1992 survey, 39 percent of Americans reported an increased vegetable consumption over what was declared 12 months previous (Subar, Heimendinger, Krebs-Smith, Patterson, Kessler, & Pivonka, 1992). Between the years of 1987 and 1991, consumers reported between a 25 to 36 percent increase in their vegetable intake, and a 32 to 40 percent increase in their fruit intake. Of the people reporting an increase in their consumption, 52 percent were aged 18 to 29 and 29 percent were over 60. This reported trend is consistent with the findings of the U.S. Department of Agriculture on food disappearance data, which indicates fruit and vegetable consumption is on the rise (Subar et al., 1992).

National Health Interview Survey

This survey examined nutrition and cancer prevention knowledge, beliefs, attitudes and the self-reported dietary changes of a United States national probability sample answered by 22,043 adults aged 18 through 99 years (Block, Patterson, & Subar, 1992). Of the subjects reporting dietary changes in the past one to five years (35%), 44.5 percent reported eating more vegetables and 24.9 percent reported eating more fruit. Of the 64.6 percent not making dietary changes for health reasons, 76.3 percent reported that they enjoyed the foods they were eating and did not want to make any changes. Sixty-nine percent of the respondents felt that their diets were already healthful and therefore there was no reason to make changes. When subjects were asked which of two statements they agreed with more - 1) diet has little effect on major disease development or 2) eating the right kind of diet can reduce the chances of developing a major disease, only 5.8 percent agreed that diet had little effect on disease. Of the respondents who agreed that diet can reduce the chance of developing a major disease, 48 percent named either cancer or heart disease.

CHAPTER III

METHODOLOGY

This chapter identifies the methods followed by the researcher in order to fulfill the objectives of the study. This includes the research design, population and sample, data collection including instrumentation and procedure, and data analysis.

Research Design

The research design of this study is a status quo survey in the form of a mailed questionnaire. A status quo survey is used in research to describe, analyze, and interpret conditions that exist. Comparison or contrast is used, and it tries to discover relationships which exist between variables (Best, 1981). The purpose of this status quo survey is to identify attitudes and knowledge regarding consumption of fruits and vegetables of Oklahoma State University students.

The dependent variables of this study were the consumption of fruits and vegetables. The independent variables were selected personal characteristics, knowledge, and attitudes of Oklahoma State University students.

Population and Sample

The population used in the study was drawn from students

18

registered at the Residential Life Office in the spring of 1993 (N=3750). From this population, a random sample of 995 students was chosen to be mailed the questionnaire. The questionnaires were distributed through campus mail to the selected students residing in six separate residence halls. Guidelines of the Oklahoma State University Institutional Review Board were followed and approval was obtained from this group for the study. Participation in this study was strictly voluntary.

Data Collection

Development of Instrument

The research instrument (Appendix A) was adapted from the Modified Willett's 1-Year Food Frequency Questionnaire (Eck & Willett, 1991), and a survey of fresh produce consumers from The Packer Focus (Fresh Trends, 1992). The content, validity, clarity, and format were examined by the research committee and students from the Approved Pre-Professional Practice Program (AP-4). Appropriate corrections were incorporated into the questionnaire.

The instrument was divided into three sections: general information, attitude/perception, and fruit and vegetable consumption questions. Section I included demographics, USDA Dietary Guidelines, and selected descriptive questions. Section II contained questions of attitudes/perceptions concerning the importance of fruit and vegetable consumption/selection. It was further divided into three sections: attitude/perception toward health and nutrition, purchasing/selection, and food safety. Section III of the instrument was designed to measure

actual consumption of 36 vegetables and 38 fruits over a seven day period.

Procedure

The instrument contained a cover letter (Appendix A) to describe the research and provide instructions for completion of the questionnaire. It also explained conditions of a drawing for two $25 dollar Joe's Clothes gift certificates, offered as an incentive to complete and return the survey. Subjects were assured that names would not be associated with individual questionnaires and data collected would be analyzed as a composite result. The duplication of questionnaires, cover letter, and printing of address labels were all provided by Dr. Huss, Director of Residential Life at Oklahoma State University. Questionnaires were mailed March 14, 1993 through campus mail. Boxes for completed questionnaires were provided at the six different resident hall offices. The respondents were given until April 6 to return the questionnaire to the boxes.

Data Analysis

The responses to the questionnaire were tabulated and coded for analysis. The data were analyzed using the Statistical Analysis System (SAS) computer program (Helwig & Council, 1979). Descriptive statistics, t-test, ANOVA, and correlation coefficients were the standard statistical procedures used. Level of significance was established at $p \leq .05$, unless otherwise specified by the researcher.

CHAPTER IV

RESULTS AND DISCUSSION

Eating a healthy diet with a variety of foods includes servings from the fruit and vegetable group daily. In this study, the consumption of fruits and vegetables of college students and the relationship between the college students' attitudes and knowledge toward fruit and vegetable consumption and how these attitudes and knowledge affect their purchasing/selection habits and consumption were studied. The data in this study were obtained using the research instrument described in Chapter III. The questionnaires were mailed to 995 randomly selected college students living in the residence halls and the total response rate was 23 percent (N=233).

Characteristics of the Respondents

To determine the characteristics of the study participants, respondents were asked to provide general demographic/personal data. Information requested included gender, race, age, education, college, and meal plan.

Age, Sex, and Race

More than half of the respondents (67%) were female and 85 percent of total respondents were Caucasian (Table I). Nearly 90 percent of the students were aged 17-22 while the remaining indicated that they were aged 23 or older (Table I).

21

TABLE I

DEMOGRAPHIC VARIABLES OF RESPONDENTS
(N=233)

Variables		Frequency	Percent	Variables		Frequency	Percent
Gender				College			
Male		76	32.6	Arts & Science		78	33.5
Female		157	67.4	Business		23	9.9
	Total	233	100.0	Human Environmental Sciences		32	13.7
				Agriculture		17	7.3
Race				Education		17	7.3
White		199	85.4	Veterinary Medicine		2	0.9
Black		10	4.3	Engineering		48	20.6
Native American		6	2.6	Graduate		3	1.3
Hispanic		2	.9	Other		13	5.6
Asian/Oriental		16	6.9		Total	233	100.1[a]
	Total	233	100.1[a]	Meal Plan			
Age Group				Yes		222	95.3
17-22		208	89.3	No		11	4.7
23-28		18	7.7		Total	233	100.0
29-33		3	1.3				
Over 33		4	1.7	Meal Plan Meals Per Week			
	Total	233	100.0	5		8	3.9
				10		75	36.9
Educational Level				15		91	44.8
Freshman		106	45.5	20		29	14.3
Sophomore		49	21.0				
Junior		37	15.9		Total	203[b]	99.9[a]
Senior		32	13.7				
Graduate		7	3.0				
Special		1	0.8				
	Total	232[b]	99.9[a]				

[a]Responses do not total 100 percent due to rounding.

[b]Responses total less than 233 because all students did not answer all questions.

Education, College, and Meal Plan

The majority of the respondents (45.5%) indicated that they were at the freshman level, while 21 percent were sophomores (Table I). Seventy-eight students (33.5%) were in the College of Arts and Sciences, followed by 20.6 percent and 13.7 percent in the Colleges of Engineering and Human Environmental Sciences respectively (Table I). Of the 233 students responding to the meal plan question, 95 percent reported having a meal plan. The majority of students (44.8%) had a 15 meals per week plan (Table I).

Responses to Descriptive Questions

To determine additional descriptive information of the survey participants, respondents were asked to provide general descriptive data. Information requested consisted of questions dealing with the number of times per week they ate meals, availability of fruits and vegetables, cooking or preparation method, marketing for fast-food restaurants, and trying a new fruit or vegetable.

Breakfast, Lunch and Dinner Per Week

On the survey instrument, students were asked how many times per week they ate breakfast, lunch and dinner. Nearly 21 percent of the students reported that they did not eat breakfast, 32 percent reported eating lunch five times per week, and 33 percent reported eating dinner five times per week (Table II).

Availability of Fruits and Vegetables

Respondents were asked if the availability of fruits and vegetables

TABLE II

RESPONSES TO DESCRIPTIVE QUESTIONS
(N=233)

Question		Frequency	Percent
Times Per Week Eating Breakfast			
0		48	20.8
1		19	8.2
2		41	17.7
3		35	15.2
4		17	7.4
5		41	17.7
6		10	4.3
7		20	8.7
	Total	231[a]	100.0
Times Per Week Eating Lunch			
0		5	2.2
1		5	2.2
2		11	4.8
3		20	8.8
4		21	9.3
5		74	32.6
6		26	11.5
7		65	28.6
	Total	227[a]	100.0
Times Per Week Eating Dinner			
0		2	0.9
1		2	0.9
2		4	1.8
3		13	5.8
4		30	13.3
5		75	33.2
6		43	19.0
7		57	25.2
	Total	226[a]	100.1[b]
Availability			
Yes		190	83.0
No		39	17.0
	Total	229[a]	100.0
Cooking/Preparation Method			
Yes		190	81.9
No		42	18.1
	Total	232[a]	100.0
Fast-foods/Sell			
Yes		174	75.3
No		57	24.7
	Total	231[a]	100.0
Fast-foods/Purchase			
Yes		143	79.0
No		38	21.0
	Total	181[a]	100.0
New Fruit or Vegetables			
Yes		78	34.5
No		148	65.5
	Total	226[a]	100.0

[a]Responses totaled less than 233 because all students did not provide information on this question.

[b]Responses do not total 100 percent due to rounding.

in their cafeteria was a factor in their selection of fruits and vegetables. Eighty-three percent (N=190) of the students answered yes, while the remaining 17 percent indicated that availability was not a factor in their selection (Table II).

Cooking/Preparation

The students were asked if cooking or preparation method was a factor in their choice of fruit and vegetable selection. Eighty-two percent (N=190) of the respondents answered yes to this question (Table II).

Fast-Food Restaurants

The survey instrument contained a question that asked the students if they thought fast-food restaurants should sell fruits and vegetables in addition to "prepackaged" and "make your own" salad bars. The majority (75.3%) answered yes, while 57 students (24.7%) answered no. If the participants answered yes, they were asked if they would purchase them. Nearly 79 percent of the respondents indicated that they would purchase fruits and vegetables in fast-food restaurants (Table II).

New Fruit or Vegetable

Nearly 66 percent (N=148) of the students indicated that they had not tried a new fruit or vegetable in the past 12 months. In contrast, 78 of the students (34.5%) indicated they had tried a new fruit or vegetable such as mangoes, starfruit (carambola) and snow peas. A few mentioned trying corn, apples and potatoes as a new fruit or vegetable (Table II).

Knowledge of Recommended Dietary Guidelines

The survey instrument also asked students about their knowledge of the USDA Dietary Guidelines. When asked how many servings of fruit to eat daily, almost 81 percent of the respondents (N=188) answered within the recommended two to four range (Table III). Eighty percent (N-182) indicated recommended daily servings in the three to five range for vegetable consumption (Table III).

TABLE III

USDA DIETARY GUIDELINES

Guideline	Frequency	Percent
Fruit		
0	1	0.4
1	11	4.8
2	61	26.4
3	79	34.2
4	48	20.8
5 or more	31	13.4
Vegetable		
0	1	0.4
1	9	3.9
2	39	16.9
3	87	37.7
4	56	24.2
5 or more	39	16.9

Attitudes of Students Towards Consumption/

Selection of Fruits and Vegetables

The survey instrument contained 20 questions in which the respondents were to circle their perception/attitudes concerning the importance of fruit and vegetable consumption/selection. The students were to choose from a scale ranging from extremely important to not very important at all. The majority of the respondents perceived the questions to be either extremely important, very important, or somewhat important.

Questions that the majority of respondents perceived as extremely important included appearance/condition, freshness/ripeness, taste/ flavor, and salmonella bacteria in produce. Concern about diet/health/ nutrition, nutritional value, convenience, and food-tampering were perceived by the majority of the respondents as very important. The remaining questions regarding calorie content, fiber content, serving size, in-season, storage/shelf life, certified residue testing, price, preservation/chemical additives, waxes/coatings, irradiated foods, and organic foods were perceived as somewhat important. Country of origin/ labeling were perceived by 72 students (32.3%) each as somewhat important or not very important (Table IV).

Fruit and Vegetable Consumption

The food frequency survey consisted of 36 different vegetables and 38 different fruits. The subjects were asked to indicate how many times they had eaten these fruits and vegetables in the past week, either per day or per week. They were told if no amount was listed to assume it

TABLE IV

ATTITUDES OF STUDENTS TOWARDS CONSUMPTION/SELECTION OF FRUITS AND VEGETABLES
(N=233)

Question	Frequency	Percent	Question	Frequency	Percent
Concern About Diet/Health/Nutrition			**Serving Size**		
Extremely important (1)	59	25.3	Extremely important	10	4.3
Very important (2)	109	46.8	Very important	63	27.0
Somewhat important (3)	56	24.0	Somewhat important	100	42.9
Not very important (4)	7	3.0	Not very important	47	20.2
Not at all important (5)	2	0.9	Not at all important	13	5.6
Nutritional Value			**In Season**		
Extremely important	47	20.2	Extremely important	26	11.2
Very important	91	39.1	Very important	43	18.5
Somewhat important	80	34.3	Somewhat important	91	39.1
Not very important	13	5.6	Not very important	50	21.5
Not at all important	2	0.9	Not at all important	23	9.9
Caloric Content			**Taste/Flavor**		
Extremely important	29	12.4	Extremely important	136	61.0
Very important	49	21.0	Very important	78	35.0
Somewhat important	72	30.9	Somewhat important	7	3.1
Not very important	59	25.3	Not very important	1	0.4
Not at all important	24	10.3	Not at all important	1	0.4
Fiber Content			**Storage/Shelf Life**		
Extremely important	22	9.4	Extremely important	33	14.8
Very important	29	12.4	Very important	68	30.5
Somewhat important	88	37.8	Somewhat important	90	40.4
Not very important	69	29.6	Not very important	23	10.3
Not at all important	25	10.7	Not at all important	9	4.0
Appearance/Condition			**Convenience**		
Extremely important	94	40.5	Extremely important	49	22.0
Very important	92	39.7	Very important	99	44.4
Somewhat important	39	16.8	Somewhat important	68	30.5
Not very important	6	2.6	Not very important	5	2.2
Not at all important	1	0.4	Not at all important	2	0.9
Freshness/Ripeness			**Certified Residue Testing**		
Extremely important	132	56.7	Extremely important	41	18.6
Very important	90	38.6	Somewhat important	45	20.4
Somewhat important	10	4.3	Somewhat important	72	32.6
Not very important	1	0.4	Not very important	46	20.8
Not at all important	-	-	Not at all important	17	7.7

TABLE IV (Continued)

Question	Frequency	Percent	Question	Frequence	Percent
Price			Waxes/Coatings		
Extremely important	43	19.4	Extremely important	40	17.9
Very important	73	32.9	Very important	67	30.0
Somewhat important	86	38.7	Somewhat important	68	30.5
Not very important	16	7.2	Not very important	35	15.7
Not at all important	4	1.8	Not at all important	13	5.8
Salmonella			Irradiated Foods		
Extremely important	74	33.3	Extremely important	31	14.4
Very important	62	27.9	Very important	50	23.3
Somewhat important	52	23.4	Somewhat important	81	37.7
Not very important	25	11.3	Not very important	30	14.0
Not at all important	9	4.1	Not at all important	23	10.7
Preservation/Chemical Additives			Country of Origin/Labeling		
Extremely important	44	19.8	Extremely important	11	4.9
Very important	57	25.7	Very important	33	14.8
Somewhat important	82	36.9	Somewhat important	72	32.3
Not very important	26	11.7	Not very important	72	32.3
Not at all important	13	5.9	Not at all important	35	15.7
Food-Tampering			Organic		
Extremely important	81	26.5	Extremely important	17	7.6
Very important	67	30.2	Very important	36	16.1
Somewhat important	45	20.3	Somewhat important	70	31.4
Not very important	20	9.0	Not very important	67	30.0
Not at all important	9	4.1	Not at all important	33	14.8

was a regular serving size. If the respondents did not consume a listed fruit or vegetable in the past week, they were asked to check the did not eat this week column. There were five columns provided for response on this section of the questionnaire; once per day, two or more per day, once per week, two or more per week, and did not eat this week. The five most frequent responses combined from the once per day and two or more per day columns were: tossed salad (26.1%); iceberg lettuce (18.1%); carrots, cooked or raw (15.1%); other 100% vegetable juice (12.8%), and tomatoes (12.4%) (Table V).

When combining responses in the once per week column and the two or more per week column, 60.4 percent of the students ate fried potatoes. Other consumption responses to these columns include 59.5 percent mashed potatoes, 56.3 percent green/yellow beans, 56.1 percent tossed salad, 54.9 percent iceberg lettuce, and 53.9 percent carrots. When responding in the did not eat column, 96.4 percent answered artichokes, 96.1 percent turnips, 94.9 percent okra (other than fried), 94.4 percent beets, 93.6 percent eggplant, and 92 percent tomato juice (Table V).

The top five most frequently consumed fruits when combining the once per day and the two or more per day column included orange juice (26.7%), juice (other 100% fruit juice) (19.5%), bananas (15.9%), apples (15%), and apple juice (13.5%). The combined responses from the once per week and two or more per week column were bananas (49.1%), orange juice (48%), apples (45.2%), oranges (43.4%) and grapes (43.4%). Papayas (97.9%), blackberries (97.7%), mangoes (97.4%), prunes (97.4%) and raspberries (97.3%) were the top five fruits not eaten by the students (Table V). Results of this study were similar to the list of the

TABLE V

FRUIT AND VEGETABLE CONSUMPTION

Vegetable/Fruit	Percent				
	Once Per Day	2 or More Per Day	Once Per Week	2 or More Per Week	Did Not Eat This Week
Broccoli	2.2	1.8	24.7	22.0	49.3
Cabbage	2.2	0.4	19.3	7.6	70.4
Cole Slaw	1.4	-	14.1	2.7	81.8
Cauliflower	1.4	0.9	19.4	16.2	62.2
Brussel Sprouts	-	0.5	5.9	2.3	91.4
Corn	2.3	2.3	27.0	10.4	58.1
Corn/Other	5.4	2.2	34.5	17.5	40.4
Peas, Green	3.6	1.3	28.7	9.4	57.0
Mixed Vegetables	4.1	3.2	18.9	15.3	58.6
Yellow Squash	0.5	0.9	9.5	3.2	86.0
Zucchini	1.3	0.4	12.9	3.4	82.0
Eggplant	0.4	0.4	2.6	3.0	93.6
Yams/Sweet Potatoes	0.4	-	9.9	3.9	85.8
Spinach	1.3	1.3	16.7	9.0	71.7
Kale/Greens	1.7	0.4	6.1	5.2	86.6
Iceberg Lettuce	15.9	5.2	19.7	35.2	24.0
Romaine Lettuce	7.3	3.0	13.7	20.2	55.8
Tomatoes	9.4	3.0	20.2	29.2	38.2
Asparagus	1.7	-	4.7	2.2	91.4
Carrots	10.8	4.3	28.9	25.0	31.0
Potatoes, Baked	6.5	4.3	30.3	20.3	38.5
Fried	8.4	2.7	31.1	29.3	28.4
Mashed	7.6	1.8	34.2	25.3	31.1
Red/New	0.9	0.9	12.7	6.3	79.2
Turnips	-	0.4	2.6	0.9	96.1
Beets	-	-	4.3	1.3	94.4
Okra, Fried	2.1	0.9	22.7	1.7	72.5
Other	0.9	-	2.8	1.4	94.9
Artichokes	-	0.4	1.8	1.3	96.4
Green/Yellow Beans	5.2	3.9	28.6	27.7	34.6
Lima Beans	0.4	1.3	7.0	2.2	89.0
Tossed Salad	18.7	7.4	19.6	36.5	17.8
Vegetable Soup	2.2	0.9	16.1	9.1	71.7
Tomato Juice	0.9	-	4.8	3.5	90.9
V-8 Juice	0.9	-	3.6	3.6	92.0
Other 100% Vegetable Juice	9.2	2.6	4.4	7.5	76.3
Apple Juice	8.1	5.4	21.7	14.9	49.8
Orange Juice	19.9	7.7	13.6	34.4	24.4
Grapefruit Juice	1.8	0.9	9.0	6.8	81.4
Juice, Other	15.0	4.5	15.0	19.1	46.4
Grapes	5.4	2.7	27.6	15.8	48.4
Bananas	13.6	2.3	25.9	23.2	35.0
Peaches	1.4	1.4	14.1	5.9	77.3
Apricots	0.5	-	5.0	2.3	92.2
Apples	9.1	5.9	23.3	21.9	39.7
Pears	2.7	1.4	10.0	6.8	79.1
Plums	2.3	1.8	12.8	5.9	77.2
Oranges	6.3	6.3	23.5	19.9	43.9
Grapefruit	2.7	0.5	8.2	7.3	81.4
Strawberries	1.4	1.4	17.2	6.3	73.8
Blueberries	0.9	-	6.4	0.9	91.8
Raspberries	-	-	2.3	0.5	97.3
Blackberries	-	-	2.3	-	97.7
Cherries	-	0.5	6.4	0.5	92.7
Cantaloupe	0.5	0.9	8.2	5.0	85.5
Watermelon	0.9	1.4	6.4	2.3	89.1
Honeydew	-	0.9	7.3	3.2	88.6
Melons, Other	0.5	0.9	1.8	3.2	93.6
Nectarines	0.5	-	3.2	1.8	94.5
Kiwi	1.4	0.9	17.3	8.6	71.8
Tangerines	1.4	0.5	4.1	1.8	92.2
Pineapples	1.8	0.9	24.5	7.3	65.5
Mangoes	0.4	-	1.7	0.4	97.4
Coconuts	-	0.9	2.1	1.3	95.7
Papayas	-	0.4	1.3	0.4	97.9
Dates	0.4	-	2.6	1.8	95.2
Raisins	2.1	1.7	13.3	12.4	70.4
Prunes	0.9	-	0.9	0.9	97.4
Peaches/Dried	-	0.4	3.4	3.4	92.7
Apricots/Dried	-	0.4	3.4	2.6	93.6
Apples/Dried	1.7	-	4.3	1.3	92.7
Bananas/Dried	1.7	-	6.4	1.3	90.6
Mixed Fruit/Dried	0.9	-	6.9	3.4	88.8
Other/Dried	1.3	-	3.0	1.7	94.0

most commonly eaten fruits and vegetables as reported by the FDA
Consumer (Kurtzweil, 1993).

Statistical Analyses

The Instrument

The survey instrument was collapsed into subgroupings for statistical analysis. Data from demographics, fruit and vegetable servings, perception/attitude, and consumption questions were collapsed into specific groupings. Twenty questions on the perception/attitudes concerning the importance of fruit and vegetable consumption/selection were collapsed into three groups: nutrition, selection/purchase, and food safety (Table VI). The 36 vegetables in the consumption section were collapsed into six groups: cabbage, starch, squash, salad, "other," and vegetable juices (Table VII). The 38 fruits were collapsed into seven groups: fruit juices, dried fruits, drupes, citrus, "other," berries, and melons (Table VII). The hypotheses were then analyzed for significance. Responses from two international graduate students skewed the data analysis. Perhaps these two students were vegetarians. One student in particular consumed unrealistic amounts of fruits and vegetables (i.e., 77 servings of one item in one day). After consulting with the research committee and statistician the researcher arbitrarily deleted data from this one respondent. The second student consumed fruits and vegetables far beyond the USDA Dietary Guidelines but were reasonable enough to be included in the data analysis.

Gender

Students' t-tests were used to determine if gender was significantly

TABLE VI

ATTITUDE/PREFERENCE GROUPS FOR
STATISTICAL ANALYSIS

Question Numbers

Nutrition

1 Concern about diet/health/nutrition
2 Nutritional value
3 Caloric content
4 Fiber content

Purchasing/Selection

5 Appearance/condition
6 Freshness/ripeness
7 Serving size
8 In season
9 Taste/flavor
10 Storage/shelf life
11 Convenience to eat/prepare
13 Price
19 Country of origin/labeling of food
20 Organically grown

Food Safety

12 Certified by residue (pesticide) testing
14 Salmonella bacteria in produce
15 Preservation and chemical additives
16 Food tampering
17 Use of waxes/coatings on fresh produce
18 Irradiated foods

TABLE VII

VEGETABLE CONSUMPTION GROUPS FOR STATISTICAL ANALYSIS

Vegetable Group	Fruit Group

Cabbage Group
   Broccoli
   Cabbage
   Cole Slaw
   Cauliflower
   Brussel Sprouts
   Kale, Mustard, Turnip, or Collard Greens
   Turnips
	Fruit Juice Group
	   Apple Juice
	   Orange Juice
	   Grapefruit Juice
	   Other 100% Fruit Juice

Starch Group
   Corn (1 ear)
   Corn, other
   Peas, green
   Yams, Sweet Potatoes
   Potatoes, Baked
        Fried
        Mashed
        Red or New Potatoes
   Lima Beans
	Drupe Group
	   Peaches
	   Apricots
	   Plums
	   Cherries
	   Nectarines

Other Group
   Mixed Vegetables
   Beets
   Okra, fried
   Vegetable Soup
	"Other" Group
	   Grapes
	   Bananas
	   Apples
	   Pears
	   Coconuts

Vegetable Juice Group
   Tomato Juice
   V-8 Juice
   Other 100% Vegetable Juice
	Citrus Group
	   Oranges
	   Grapefruit
	  *Kiwi
	   Tangerines
	   Pineapples
	  *Mangoes
	  *Papayas

Salad Group
   Spinach, cooked or raw
   Tomatoes
   Carrots, cooked or raw
   Tossed Salad
   Iceberg Lettuce
	Berry Group
	   Strawberries
	   Blueberries
	   Raspberries
	   Blackberries

Squash/Low Calorie
   Yellow Squash
   Zucchini
   Eggplant
   Asparagus
   Okla, other
   Artichokes
   Green/Yellow Beans
	Dried Group
	   Dates
	   Raisins
	   Prunes
	   Peaches, dried
	   Apricots, dried
	   Apples, dried
	   Bananas, dried
	   Mixed Fruit, dried
	   Other Fruit, dried

	Melon Group
	   Cantaloupe
	   Watermelon
	   Honeydew
	   Melons, other

*These fruits are included in the citrus group because of their Vitamin C content.

associated (p<.05) with the variables indicated in the hypotheses. It was determined that males consumed more fruit juice (p=0.0560), drupes (p=0.0003), and melons (p=0.0001) in the fruit groups. They also consumed more vegetables from the cabbage group (p=0.0006), starch group (p=0.0001) (Table VIII). Similar findings in data from the NHANES II survey (Patterson et al., 1990), reported that 31 percent of white males and 21 percent of black males consumed three or more servings of vegetables per day, while only 25 percent of white females and 18 percent of black females consumed three or more servings of vegetables per day.

Race

The students' t-tests were used to determine if significant associations (p<.05) existed between race and selected variables stated in the hypotheses. Race was collapsed into Whites (N=199, 84%) and other (N=34), 14.6%) due to the small number of minority respondents. The minority group consumed significantly more drupes (p=0.0049), citrus (p=0.0001), dried fruits (p=0.0175), "other" fruits (p=0.0001), berries (p=0.0039), and melons (p=0.0001) (Table IX). The same group also consumed significantly more vegetables from the cabbage group (p=0.0004), starch group (p=0.0001), squash group (p=0.0001), salad group (p=0.0153), and "other" vegetable group (p=0.0001) (Table IX). These data may be significant due to the small number of minorities and extremely high consumption of fruits and vegetables indicated by one Asian student. As noted earlier, data from the NHANES II survey reported lower fruit and vegetable consumption among Blacks than Whites (Patterson et al., 1990), but it did not survey other minorities.

TABLE VIII

T-TEST DETERMINATION ON CONSUMPTION OF FRUITS AND
VEGETABLES BY GENDER OF RESPONDENTS

Fruit/Vegetable Group	Female		Male		
	N	Mean	N	Mean	P-Value
Juice	145	7.78	74	9.80	0.0560
Drupe	144	1.35	72	2.35	0.0003
Melon	145	0.69	74	1.99	0.0001
Cabbage	141	3.46	72	3.99	0.0006
Starch	139	8.94	68	13.03	0.0001
Squash	127	3.19	69	2.73	0.0093
Other	147	2.23	72	3.17	0.0001

TABLE IX

T-TEST DETERMINATION ON CONSUMPTION OF FRUITS AND VEGETABLES
BY RACE OF THE RESPONDENTS

Fruit/Vegetable Group	White		Other		
	N	Mean	N	Mean	P-Value
Drupe	184	1.47	32	2.91	0.0049
Citrus	186	3.77	32	7.56	0.0001
Dried	191	1.84	33	2.85	0.0175
Other	187	6.19	31	10.29	0.0001
Berries	186	0.77	32	1.28	0.0039
Melons	187	0.76	32	3.28	0.0001
Cabbage	181	3.19	32	6.16	0.0004
Starch	175	9.13	32	16.56	0.0001
Squash	166	2.81	30	4.20	0.0006
Salad	196	13.17	32	16.47	0.0153
Other	187	2.23	32	4.34	0.0001

Knowledge of Fruit and Vegetable Servings

Knowledge of fruit and vegetable guidelines were compared with the independent variables; fruit and vegetable consumption, and dependent variables, demographics and attitude/preference questions. Students' t-tests were used to determine significant ($p<.05$) associations. The number of fruit servings for the USDA Dietary Guideline questions were collapsed into two groups (0-1 servings and 2-4 or more servings) for analysis. The vegetable servings were also collapsed into groups (0-2 servings and 3-5 or more servings) for statistical purposes. When analyzing recommended fruit servings responses to fruit consumption patterns, the students reported increased intake of drupes ($p=0.0365$), dried fruits ($p=0.0001$) and melons ($p=0.0395$) (Table X). A significant increase in the starch group ($p=0.0002$) was noted when comparing fruit serving responses to vegetable consumption patterns of the respondents. When comparing vegetable serving responses to fruit consumption responses, increases were noted in the consumption of dried fruit ($p=0.0001$), berries ($p=0.0001$) and melons ($p=0.0001$) (Table X). Responses to knowledge of USDA's Dietary Guideline questions, vegetable serving and vegetable consumption patterns showed increases in the consumption of the starch group ($p=0.0017$), squash group ($p=0.0105$), salad group ($p=0.0001$), and vegetable juice group ($p=0.0001$) (Table X). In a previous study, Melby, Femea and Sciacca (1986) reported that 95 percent of college students surveyed indicated that a healthy diet would include eating servings of fruits and vegetables each day; however, 43 percent ate no vegetable servings and 69 percent ate no servings of fruit.

TABLE X

T-TEST DETERMINATION ON CONSUMPTION OF FRUITS AND VEGETABLES
BY RECOMMENDED FRUIT AND VEGETABLE SERVINGS

Fruit/Vegetable Group	0-1 Servings Per Day		2 or More Servings Per Day		P-Value
	N	Mean	N	Mean	
	Fruit Serving				
Drupe	10	.70	204	1.75	0.0365
Dried Fruit	12	.50	210	2.09	0.0001
Melons	12	1.67	205	1.14	0.0395
Starch	12	14.33	195	10.03	0.0002
	Vegetable Serving				
Dried Fruit	50	1.28	174	2.20	0.0001
Berries	49	1.08	169	0.78	0.0001
Melons	49	2.16	170	0.83	0.0001
Starch	45	10.42	162	10.24	0.0017
Squash	47	2.36	149	3.24	0.0105
Salad	50	9.46	178	14.80	0.0001
Vegetable Juice	49	2.10	170	2.67	0.0001

Age

Analysis of variance (ANOVA) procedures were used to determine significant associations between age and specific variables in the hypotheses. Age was collapsed into three groups; 17-22, 23-28, and 29 and older for statistical analysis. The age group, 23-28 (N=17), consumed significantly more melons (p=0.0013) than the other groups (Tables XI and XII). Respondents in the 29 and older group consumed more vegetables from the cabbage group (p=0.0001) (Tables XIII and XIV). This age group also consumed significantly more vegetables (p=0.0091) from the "other" vegetable group (Tables XV and XVI). Another study

(<u>Fresh Trends</u>, 1992) reported increased consumption of fruits and vegetables as age increased.

TABLE XI

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR MELON
CONSUMPTION AND AGE

Source	df	Mean Square	F	P*
Age 23 - 28	2	124.77	6.84	0.0013
Error	216	18.24		
Total	218			

*Significant level at p<0.05

TABLE XII

DUNCAN'S MULTIPLE RANGE TEST FOR THE CONSUMPTION
OF MELONS AND AGE

Age	N	Mean	Grouping*
17 - 22	195	0.79	B
23 - 28	17	4.77	A
29 and older	7	1.71	AB

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XIII

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR CABBAGE GROUP
CONSUMPTION AND AGE

Source	df	Mean Square	F	P*
Age 29 and older	2	278.19	16.40	0.0001
Error	210	16.97		
Total	212			

*Significant level at p<0.05.

TABLE XIV

DUNCAN'S MULTIPLE RANGE TEST FOR THE CONSUMPTION
OF CABBAGE GROUP AND AGE

Age	N	Mean	Grouping*
17 - 22	189	3.14	B
23 - 28	17	6.06	B
29 and older	7	11.29	A

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XV

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR FRUIT
AND VEGETABLE CONSUMPTION AND AGE

Source	df	Mean Square	F	P*
Age 29 and older	2	78.32	4.80	0.0091
Error	216	16.30		
Total	218			

*Significant level at p<0.05.

TABLE XVI

DUNCAN'S MULTIPLE RANGE TEST FOR THE CONSUMPTION
OF FRUIT AND VEGETABLES AND AGE

Age	N	Mean	Grouping*
17 - 22	195	2.25	AB
23 - 28	17	4.65	B
29 and older	7	5.57	A

*Means with the same letter are not significantly different
at the 0.05 level.

Education

Analysis of variance (ANOVA) procedures were used to determine significant (p<.05) associations between education level and specific variables in the hypotheses. Using Duncan's Multiple range test, graduate students indicated a significantly increased intake from the cabbage (p=0.0007) and vegetable juice (p=0.0147) groups (Tables XVII, XVIII, XIX, XX). When using a significance level of p<.1, those students in the graduate college consumed more "other" vegetables (p=0.0601) than did students at the freshman and sophomore level of education (Tables XXI, XXII). Junior students consumed more vegetables from the starch group (p=0.0771) at the p<.1 level of significance according to ANOVA procedures (Table XXIII).

TABLE XVII

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR EDUCATION
AND CABBAGE CONSUMPTION

Source	df	Mean Square	F	P*
Education Level	4	90.02	4.98	0.0007
Error	208	18.07		
Total	212			

*Significant level at p<0.05.

TABLE XVIII

DUNCAN'S MULTIPLE RANGE TEST FOR EDUCATION
AND CABBAGE CONSUMPTION

Education	N	Mean	Grouping*
Graduate	7	7.57	A
Senior	31	4.87	B
Junior	35	4.60	B
Sophomore	43	4.20	B
Freshman	97	2.36	B

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XIX

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR EDUCATION
AND VEGETABLE JUICE CONSUMPTION

Source	df	Mean Square	F	P*
Education Level	4	32.75	3.17	0.0147
Error	214	10.33		
Total	218			

*Significant level at $p < 0.05$.

TABLE XX

DUNCAN'S MULTIPLE RANGE TEST FOR EDUCATION
AND VEGETABLE JUICE CONSUMPTION

Education	N	Mean	Grouping*
Graduate	6	5.17	A
Sophomore	47	1.94	B
Junior	34	1.77	B
Freshman	101	1.28	B
Senior	31	0.45	B

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XXI

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR EDUCATION
AND "OTHER" VEGETABLE CONSUMPTION

Source	df	Mean Square	F	P*
Education Level	4	37.87	2.30	0.0601
Error	214	16.48		
Total	218			

*Significant level at $p < 0.1$.

TABLE XXII

DUNCAN'S MULTIPLE RANGE TEST FOR EDUCATION
AND "OTHER" VEGETABLE CONSUMPTION

Education	N	Mean	Grouping*
Graduate	7	5.14	A
Senior	31	3.48	AB
Junior	35	3.43	AB
Freshman	100	2.14	B
Sophomore	46	1.70	B

*Means with the same letter are not significantly different
at the 0.1 level.

TABLE XXIII

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR EDUCATION
AND THE STARCH GROUP CONSUMPTION

Source	df	Mean Square	F	P*
Education Level	4	234.27	2.14	0.0771
Error	202	109.41		
Total	206			

*Significant level at $p < .1$.

College

There was a significant association (p=0.0552) between the graduate college and the variable selection/purchasing of fruits and vegetables (Table XXIV). Using Duncan's Multiple Range Test for variables, graduate students consumed significantly (p=0.0140) more dried fruit than respondents in the College of Education and "other" colleges (Tables XXV, XXVI). In addition, graduate students consumed significantly (p=0.0046) more fruit from the melon group than respondents from other colleges (Tables XXVII, XXVIII). When analyzing vegetable consumption, the College of Education student had a significantly (p=0.0040) more intake from the starch group (Table XXIX). Students in the graduate college consumed significantly more vegetables from the salad group (p=0.0407) and from the cabbage group (Tables XXX, XXXI, XXXII).

TABLE XXIV

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR COLLEGE
AND SELECTION/PURCHASING

Source	df	Mean Square	F	P*
College Level	8	0.4568	1.94	0.0552
Error	211	0.2351		
Total	219			

*Significant level at p<.05.

TABLE XXV

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR COLLEGE
AND DRIED FRUIT CONSUMPTION

Source	df	Mean Square	F	P*
College Level	8	54.4821	2.47	0.0140
Error	215	22.0564		
Total	223			

*Significant level at $p < .05$.

TABLE XXVI

DUNCAN'S MULTIPLE RANGE TEST FOR COLLEGE
AND DRIED FRUIT CONSUMPTION

College	N	Mean	Groupings*
Graduate	3	6.33	A
Human Environmental Sciences	31	4.90	AB
Veterinary Medicine	2	3.00	AB
Arts & Sciences	78	1.92	AB
Business	20	1.90	AB
Agriculture	16	1.25	AB
Engineering	46	1.00	AB
Education	15	0.67	B
Other	13	0.39	B

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XXVII

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR COLLEGE
AND MELON GROUP CONSUMPTION

Source	df	Mean Square	F	P*
College Level	8	163.14	11.87	0.0001
Error	210	13.74		
Total	218			

*Significant level at p<.05.

TABLE XXVIII

DUNCAN'S MULTIPLE RANGE TEST FOR COLLEGE
AND MELON GROUP CONSUMPTION

College	N	Mean	Groupings*
Graduate	3	21.67	A
Engineering	45	1.16	B
Education	17	1.06	B
Business	23	1.04	B
Human Environmental Sciences	30	1.03	B
Other	13	0.85	B
Arts & Sciences	71	0.65	B
Veterinary Medicine	2	0.00	B
Agriculture	15	0.00	B

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XXIX

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR COLLEGE
AND STARCH GROUP CONSUMPTION

Source	df	Mean Square	F	P*
College Level	8	301.10	2.89	0.0046
Error	198	104.19		
Total	206			

*Significant level at p<.05.

TABLE XXX

ANALYSIS OF VARIANCE (ANOVA) RESULTS FOR COLLEGE
AND SALAD GROUP CONSUMPTION

Source	df	Mean Square	F	P*
College Level	8	287.26	1.98	0.0497
Error	219	144.84		
Total	227			

*Significant level at p<0.05.

TABLE XXXI

DUNCAN'S MULTIPLE RANGE TEST FOR COLLEGE
AND SALAD GROUP CONSUMPTION

College	N	Mean	Groupings*
Graduate	3	32.67	A
Education	17	16.77	B
Engineering	46	15.91	B
Other	13	15.00	B
Arts & Sciences	76	13.18	B
Human Environmental Sciences	31	12.90	B
Veterinary Medicine	2	11.00	B
Business	23	9.52	B
Agriculture	17	9.12	B

*Means with the same letter are not significantly different
at the 0.05 level.

TABLE XXXII

DUNCAN'S MULTIPLE RANGE TEST FOR COLLEGE
AND CABBAGE GROUP CONSUMPTION

College	N	Mean	Groupings*
Graduate	3	10.67	A
Human Environmental Sciences	28	4.25	B
Veterinary Medicine	2	4.00	B
Engineering	45	3.91	B
Agriculture	15	3.87	B
Arts & Sciences	70	3.56	B
Business	22	3.18	B
Education	17	2.94	B
Other	11	1.18	B

*Means with the same letter are not significantly different
at the 0.05 level.

Attitudes/Preferences Toward Fruit and

Vegetable Consumption/Selection

The attitudes/preferences concerning fruit and vegetable con-
sumption/selection were associated with increased fruit and vegetable
consumption patterns. The 20 questions in this section were collapsed
into three groups for statistical purposes (Table VI). In the first
group, nutrition, more intake was seen with fruit juice (p=0.0054),
citrus (p=0.0034), dried fruit (p=0.0039), and "other" fruit (p=0.0003)
consumption (Table XXXIII). From the vegetable groups there were
significantly more intakes of cabbage (p=0.0023), squash (p=0.0030),
and "other" vegetables (p=0.0021) (Table XXXIII).

The second attitude/preference group contained questions dealing
with the importance of selection/purchasing of fruits and vegetables.
Increased consumption of vegetables from the starch group (p=0.0167),
squash group (p=0.0048), salad group (p=0.0037), and "other" vegetable
group (p=0.0428) were significantly associated with consumption/
selection questions.

The third group of questions dealt with food safety concerns of
fruit and vegetable consumption/selection. The food safety questions
were significantly associated with increased intakes of vegetables
from the squash group (p=0.0110), salad group (p=0.0010), "other"
vegetable group (p=0.0259), and vegetable juice (p=0.0258) (Table
XXXIII).

Testing of Hypotheses

Hypothesis one stated that there will be no significant associa-
tion between fruit and vegetable consumption patterns of college students

TABLE XXXIII

CORRELATION COEFFICIENTS FOR SELECTED VARIABLES

Variables	Nutrition	Selection/Purchase	Food Safety
Nutrition	r = 1.00 p = 0.00	r = 0.33 p = 0.0001	r = 0.41 p = 0.0001
Selection/Purchase	r = 0.33 p = 0.0001	r = 1.00 p = 0.0000	r = 0.60 p = 0.0001
Food Safety	r = 0.41 p = 0.001	r = 0.60 p = 0.0001	r = 1.00 p = 0.0
Fruit Juice	r =-0.19 p = 0.0054	r =-0.08 p = 0.2677	r =-0.11 p = 0.1115
Drupe	r =-0.10 p = 0.1516	r =-0.09 p = 0.2011	r =-0.07 p = 0.3187
Citrus	r =-0.20 p = 0.0034	r =-0.09 p = 0.1821	r =-0.07 p = 0.2856
Dried Fruit	r =-0.19 p = 0.0039	r =-0.01 p = 0.9263	r =-0.04 p = 0.5424
Other Fruit	r =-0.25 p = 0.0002	r =-0.11 p = 0.1180	r =-0.05 p = 0.4339
Berries	r =-0.07 p = 0.2856	r =-0.10 p = 0.1465	r =-0.04 p = 0.5759
Melons	r =-0.016 p = 0.8146	r =-0.08 p = 0.2456	r =-0.09 p = 0.2019
Cabbage	r =-0.21 p = 0.0023	r =-0.02 p = 0.8274	r =-0.10 p = 0.1380
Starch	r =-0.06 p = 0.3751	r =-0.17 p = 0.0167	r =-0.12 p = 0.0921
Squash	r =-0.21 p = 0.0030	r =-0.20 p = 0.0048	r =-0.19 p = 0.0110
Salad	r =-0.12 p = 0.1033	r =-0.20 p = 0.0037	r =-0.23 p = 0.0010
Other Vegetables	r =-0.21 p = 0.0021	r =-0.14 p = 0.0428	r =-0.15 p = 0.0259
Vegetable Juice	r =-0.12 p = 0.0759	r =-0.07 p = 0.2831	r =-0.16 p = 0.0258

and the selected personal variables of gender, race, age, education level and college. Significant associations in some of the demographic variables and fruit and vegetable consumption were noted as shown in Tables VIII through XXXII, hence, the researcher rejects null hypothesis one.

Hypothesis two stated that there will be no significant association between the fruit and vegetable consumption patterns of college students and their attitudes about fruits and vegetables relative to health, nutrition, selection patterns, and food safety. According to data in Table XXXIII, significant associations were found in the students' attitudes and their fruit and vegetable consumption patterns. For this reason the third null hypothesis is rejected.

The third hypothesis stated that there will be no significant association between the college students' personal variables and their attitudes toward fruit and vegetable consumption. There were no significant associations between college students' personal variables and their attitudes toward fruit and vegetable consumption, therefore the researcher failed to reject the third null hypothesis

The fourth hypothesis stated that there will be no significant associations between college students' personal variables and the recommended dietary guidelines of fruit and vegetable consumption. There were no significant associations, hence the researcher failed to reject null hypothesis four.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

There are several consumption studies of college students reported
in the literature, however, few have focused specifically at fruit and
vegetable intake. The intent of this research was to determine the
kind and amount of fruits and vegetables consumed by college students
and how their attitudes and knowledge influence their consumption of
fruits and vegetables. Five hypotheses were postulated to determine
if the college students' consumption of fruits and vegetables were
effected by demographic variables and their knowledge (Recommended
Dietary Guidelines) and attitudes.

The results of the data collected from the questionnaires com-
pleted by the college students are presented in Chapter IV. The sample
population was randomly drawn from students living in residence halls
at Oklahoma State University. Data obtained from the 233 questionnaires
were analyzed using frequencies, percentages, t-tests, correlations
and ANOVA and Duncan's Multiple Range Tests.

The majority of the respondents were freshman white females aged
17-22 in the College of Arts and Sciences (Table I). Over 95 percent
of the students had a meal plan, with the most reporting a 10 or 15
meals per week plan (Table I). Only 17.7 percent of the students ate
breakfast five times per week, while 32.6 percent ate lunch and 33.2
percent ate dinner five times per week (Table II). The majority of the

students had knowledge of the USDA's Dietary Guidelines (Table III). Availability and cooking/preparation methods of fruits and vegetables were factors in selection of fruits and vegetables for most students (Table II). The majority of the respondents felt that fast food restaurants should sell fruits and vegetables in addition to "prepackaged" and "make your own" salad bar and indicated that they would purchase them (Table II).

Appearance/condition, freshness/ripeness, and taste/flavor were perceived as very important in fruit and vegetable consumption/selection by a majority of the students. Other attitude/perception questions viewed as important included diet/health/nutrition, nutritional value, and convenience (Table IV). Perception/attitudes of nutrition concerning the importance of fruit and vegetable consumption/selection was associated with increased intake of many fruits and vegetables (Table XXXIII).

Commonly consumed fruits included bananas, apples, orange juice, oranges, and other 100 percent fruit juice (Table V). Tossed salads, fried and mashed potatoes and carrots were vegetables commonly consumed by the respondents (Table V). Males consumed more fruits and vegetables from some groups such as the starch and fruit juice groups (Table VIII). In addition, graduate and minority students consumed greater amounts and varieties of some fruits and vegetables (Tables XVII-XXIII). Students in the 23-28 and the 29 and older age groups consumed more fruit and vegetables from some of the groups (Tables XI-XVI).

Recommendations

The research instrument covered a broad area and the questionnaire

was lengthy. To increase response rate and more in-depth analysis of the data, future researchers may wish to shorten the instrument or separate fruit from vegetable consumption. In addition, the time of year the questionnaire is distributed may need to be considered. Early fall might be a better time because of a larger variety of fruits and vegetables in season and students may not be too involved in many extra-curricular activities. Future researchers might need to coordinate their survey instrument closely to that of the residence halls menus for accuracy of fruit and vegetable varieties.

Additional research needs to be conducted nationwide to discover the actual fruit and vegetable consumption of young adults. Other studies should be conducted on barriers and possible solutions to the consistent shortfall of daily consumption of fruits and vegetables.

Implications

Knowledge to include appropriate amounts of fruits and vegetables in the diet appeared to be evident among college students, however, consumption still remains below the USDA Dietary Guidelines. Educators need to identify barriers contributing to low fruit and vegetable con-sumption by teens and college students. Indicators from this survey suggest that fast food restaurants might be a good place to market fruits and vegetables; however, technology must play a part in order for fast food establishments to provide consistently superior products. Cafeterias need to creatively market fruits and vegetables via vending machines in strategic locations and market fruits and vegetables in attractive brown bag lunches. In addition, cafeterias should strive to find consistent and better preparation methods so that products

viewed will appeal to the senses of these age groups. Nutrition and health care educators need to find creative ways to help consumers reach the recommended goals of fruit and vegetable consumption. Multi-media presentations (TV, radio, print and other) to the general public regarding the benefits of including more fruits and vegetables in the diet for the promotion and maintenance of optimum health is imperative.

BIBLIOGRAPHY

Ames BN, Magan R. Ranking possible carcinogenic hazards. Science.
    1987; 36:271-280.

Axelson ML, Brinberg D. A Social-Psychological Perspective on Food-
    Related Behavior. New York: Springer-Verlag; 1987.

Beerman KA, Jennings G, Crawford S. The effect of student residence
    on food choice. College Health. 1990; 38:215-220.

Bennion M. Introductory Foods. New York: MacMillan Publishing; 1990.

Best JW. Research in Education. Englewood Cliffs, NJ: Prentice-Hall;
    1981.

Block G, Patterson B, Subar A. Fruit, vegetables, and cancer pre-
    vention: A review of the epidiological evidence. Nutrition and
    Cancer. 1992; 18(1):1-29.

Britt EC. Health people 2000. Journal of the American Dietetic
    Association. 1990; 90(9):1215.

Carrol MD, Abraham S, Dresser CM. Dietary Intake Source Data: United
    States, 1976-80. Vital and Health Statistics Series 11-No. 231.
    Hyattsville, MD: National Center for Health Statistics; 1983.
    DHHS Publication (PHS) 83-1681.

Chaisson CF, Peterson B, Douglass J. Pesticides in Food: A Guide for
    Professionals. Chicago: American Dietetic Association; 1991; 1-23.

CSF II. Nationwide Food Consumption Survey. Continuing Survey of Food
    Intake by Individuals, Women 19-50 and Their Children 1-5 Years,
    4 Days 1986. NFCS, CSF-II Report No. 86-3, Hyattsville, MD:
    Human Nutrition Information Service; 1988.

Department of Health and Human Services. The Surgeon General's Report
    on Nutrition and Health. Washington, DC: U. S. Department of
    Health and Human Services; 1988. DHHS (PHS) Publication 88-50210.

Department of Health and Human Services, Office of Disease Prevention
    and Health Promotion Report. Promoting Health/Preventing Disease,
    Year 2000 Objectives for the Nation. Washington, DC: Public
    Health Service; 1991; 112-127.

Eck L, Willett WC. Considerations in modifying a semiquantitative food frequency questionnaire. Journal of the American Dietetic Association. 1991; 91:970-973.

Fishbein M, Ajzen I. Belief, Attitude Intention and Behavior; An Introduction to Theory and Research. Reading, MA: Addison Wesley Publication; 1975; 12.

Food Research Institute. Food Safety 1990: An Annotated Bibliography of the Literature. Boston: Butterworth Heinemann; 1991.

Fresh Trends '92: A Profile of Fresh Produce Consumers. Shawnee Mission, KS: Vance Publishing; 1992.

Gormley TR, Downey G, O'Beirne D. Food, Health and the Consumer. London and New York: Elsevier Applied Science; 1987.

Helwig TG, Council KA. SAS User's Guide. Raleigh, NC: SAS Institute; 1979.

Hernon JF, Skinner JD, Andrews FE, Penfield MP. Nutrient intakes and foods selected by college students: Comparisons among subgroups divided by energy intake. Journal of the American Dietetic Association. 1986; 86(2):217-221.

Horwath CC, Worsley A. Dietary habits of elderly persons with diabetes. Journal of the American Dietetic Association. 1991; 91(5):553-57.

Human Nutrition Information Service. Nutrient Intakes: Individuals in 48 States, Year 1977-78. Nationwide Food Consumption Survey 1977-78. Hyattsville, MD: U. S. Department of Agriculture. 1984; Report 1-2.

IFT. Dietary fiber - A scientific status summary by the Institute of Food Safety and Nutrition. Food Technology. 1989; 43(10):133.

Kramer A, Twiggs BB. Quality Control for the Food Industry: AVI. New York: Van Nostrand Reinhold Co; 1970.

Kurtzweil P. Nutrition Information Available for Raw Fruits, Vegetables, Fish. FDA Consumer: Focus on Food Labeling. Rockville, MD: Food and Drug Administration, May 1993; 51-55.

Loughrey K, Doner L, Lurie D. Insight Into Fruit and Vegetable Consumption: A Summary of Recent Findings for Planning the 5 A Day Program. Atlanta, GA: National Cancer Institute; June 8, 1992.

Marrale JC, Shipman JH, Rhodes ML. What some college students eat. Nutrition Today. Jan/Feb 1986; 19-26.

Melby CL, Femea PL, Sciacca JP. Reported dietary and exercise behaviors, beliefs and knowledge among university undergraduates. Nutrition Research. 1986; 6:799-808.

National Academy of Sciences, National Research Council, Food and Nutrition Board, Committee on Diet and Health. Diet and Health: Implications for Reducing Chronic Disease Risk. Washington, DC: National Academy Press; 1989.

Nilsson TK, Sundell IB, Hellsten G, Hallmans G. Reduced plasminagen activator inhibitor activity in high consumers of fruits, vegetables and root vegetables. Journal of Internal Medicine. 1990; 227(4):267-71.

Patterson HB, Block G. Food choices and the cancer guidelines. American Journal of Public Health. 1988; 78:282-286.

Patterson HB, Block G, Rosenberger WF, Pee D, Kahle LL. Fruit and vegetables in the American diet: Data from the NHANES II Survey. American Journal of Public Health. 1990; 80(12):1443-1449.

Shewfelt RL. Quality of fruits and vegetables. Food Technology. June 1990; 99-106.

Subar AS, Heimendinger J, Krebs-Smith SM, Patterson BH, Kessler R, Pivonka E. 5 A Day for Better Health: A Baseline Study of America's Fruit and Vegetable Consumption. Washington, DC: National Cancer Institute. July, 1992.

U. S. Department of Agriculture. Human Nutrition Information Service. Dietary Guidelines for Americans. Washington, DC: U. S. Government Printing Office; 1990. Home and Garden Bulletin No. 232.

Willett WC, Sampson L, Stampfer MJ, Rosner B, Bain C, Witschi J, Hennekens CH, Speizer FE. Reproducibility and validity of a semiquantitative food frequency questionnaire. American Journal of Epidemiology. 1985; 122(1):51-65.

APPENDICES

APPENDIX A

COVER LETTER AND QUESTIONNAIRE

Oklahoma State University

DEPARTMENT OF NUTRITIONAL SCIENCES
COLLEGE OF HUMAN ENVIRONMENTAL SCIENCES

STILLWATER, OKLAHOMA 74078-0337
425 HUMAN ENVIRONMENTAL SCIENCES
(405)-744-5040

March 22, 1993

Dear Student:

Congratulations! You have been selected to participate in a very important study entitled "Fruit and Vegetable Consumption of College Students." The USDA Dietary Guidelines and Healthy People 2000 both recommend increased fruit and vegetable consumption every day. To date however, only one national study has been published to measure the US population's fruit and vegetable intake.

Please take 15 minutes of your time to complete the questionnaire provided. Your cooperation and participation are very much appreciated. A summary of results will be made available to the Department of Residential Life in Iba Hall.

In appreciation for taking part in this study, **there will be a drawing for two $25 dollar gift certificates to the Eskimo Joe's clothing store**. Upon completion of the survey, spaces are provided for appropriate information needed for the drawing entry. After receiving a completed questionnaire, the entry information will be immediately detached and data will be analyzed as a composite result , not individually.

Please staple your questionnaire closed, and place in the box provided near the Residential Life front desk **by April 6, 1993**. Again, we thank you for your time and participation in this project. We will look forward to hearing from you soon.

Sincerely,

Rebecca Plato
Rebecca Plato
Graduate Student

Lea L. Ebro Ph.D.
Major Advisor

lle-599

Fruit and Vegetable Consumption of College Students

Please check or fill in the appropriate information concerning yourself.

1. **Gender** __Male __Female

2. **Race** __White __Black __Native American __Hispanic __Asian/Oriental

3. **Age group** __17-22 __23-28 __29-33 __over 33

4. **Educational level** __freshman __sophomore __junior __senior __graduate __special

5. **College** __Arts & Science __Business __Human Environmental Sciences __Agriculture
   __Education __Veterinary Medicine __Engineering __Graduate __Other

6. Do you have a meal plan __yes __no If yes, state number of meals per week _____

7. How many times per week did you eat **breakfast**____ **lunch**____ **dinner**____

8. A healthy diet will include eating how many servings of fruit each day
   __0 __1 __2 __3 __4 __5 **or more**

9. A healthy diet will include eating how many servings of vegetables each day
   __0 __1 __2 __3 __4 __5 **or more**

10. Is the availability of fruits and vegetables in your cafeteria a factor in your selection of fruits
    and vegetables? __yes __no

11. Is cooking or preparation method a factor in your fruit and vegetable selection? __yes __no

12. Should fast-food restaurants sell fruits and vegetables in addition to "prepackaged" and
    "make your own" salad bars? __yes __no If yes, would you purchase them? __yes __no

13. Have you tried a new fruit or vegetable in the past 12 months? __yes __no
    If yes, please specify: _____

**Please circle your perceptions/attitudes concerning the importance of fruit and
vegetable consumption/selection.**

	Extremely Important	Very Important	Somewhat Important	Not Very Important	Not At All Important
1. Concern about diet/health/nutrition	1	2	3	4	5
2. Nutritional value	1	2	3	4	5
3. Caloric content	1	2	3	4	5
4. Fiber content	1	2	3	4	5
5. Appearance/condition	1	2	3	4	5
6. Freshness/ripeness	1	2	3	4	5
7. Serving size	1	2	3	4	5
8. In Season	1	2	3	4	5

	Extremely Important	Very Important	Somewhat Important	Not Very Important	Not At All Important
9. Taste/flavor	1	2	3	4	5
10. Storage/shelf life	1	2	3	4	5
11. Convenience to eat/prepare	1	2	3	4	5
12. Certified by residue (pesticide) testing	1	2	3	4	5
13. Price	1	2	3	4	5
14. Salmonella bacteria in produce	1	2	3	4	5
15. Preservation and chemical additives	1	2	3	4	5
16. Food-tampering	1	2	3	4	5
17. Use of waxes/coatings on fresh produce	1	2	3	4	5
18. Irradiated foods	1	2	3	4	5
19. Country of origin/labeling of food	1	2	3	4	5
20. Organically grown	1	2	3	4	5

For the following fruits and vegetables, please tell us how many times you had them in the PAST WEEK, either per day or per week. If there is no amount listed, assume that we are talking about a regular size serving. If you did not consume that food this past week, please check the did not eat this week column.

Cup=c=8oz	Once Per Day	2 or more Per Day	Once Per Week	2 or more Per Week	Did Not Eat This Week
Broccoli (1/2 c)	___	___	___	___	___
Cabbage/ (1/2 c)	___	___	___	___	___
Cole slaw (1/2 c)	___	___	___	___	___
Cauliflower (1/2 c)	___	___	___	___	___
Brussel sprouts (1/2 c)	___	___	___	___	___
Corn (1 ear)	___	___	___	___	___
Corn, other (1/2 c)	___	___	___	___	___
Peas, green (1/2 c)	___	___	___	___	___
Mixed vegetables (1/2 c)	___	___	___	___	___
Yellow (winter) squash (1/2 c)	___	___	___	___	___

Continued on the next page

Cup=c=8oz	Once Per Day	2 or more Per Day	Once Per Week	2 or more Per Week	Did Not Eat This Week
Zucchini, summer squash (1/2 c)	⎯	⎯	⎯	⎯	⎯
Eggplant (1/2 c)	⎯	⎯	⎯	⎯	⎯
Yams or sweet potatoes (1/2 c)	⎯	⎯	⎯	⎯	⎯
Spinach cooked or raw (1/2 c)	⎯	⎯	⎯	⎯	⎯
Kale, mustard, turnip, or collard greens (1/2 c)	⎯	⎯	⎯	⎯	⎯
Iceberg lettuce (1/2 c)	⎯	⎯	⎯	⎯	⎯
Romaine lettuce (1/2 c)	⎯	⎯	⎯	⎯	⎯
Tomatoes (1)	⎯	⎯	⎯	⎯	⎯
Asparagus (1/2 c)	⎯	⎯	⎯	⎯	⎯
Carrots, cooked (1/2 c) or raw (1c)	⎯	⎯	⎯	⎯	⎯
Potatoes, baked (1/2)	⎯	⎯	⎯	⎯	⎯
fried (1/2 c)	⎯	⎯	⎯	⎯	⎯
mashed (1/2c)	⎯	⎯	⎯	⎯	⎯
red or new potatoes (1/2 c)	⎯	⎯	⎯	⎯	⎯
Turnips (1/2 c)	⎯	⎯	⎯	⎯	⎯
Beets (1/2 c)	⎯	⎯	⎯	⎯	⎯
Okra, fried (1/2 c)	⎯	⎯	⎯	⎯	⎯
other (1/2 c)	⎯	⎯	⎯	⎯	⎯
Artichokes (1/2 c)	⎯	⎯	⎯	⎯	⎯
Green beans or yellow beans (1/2 c)	⎯	⎯	⎯	⎯	⎯
Lima beans (1/2 c)	⎯	⎯	⎯	⎯	⎯
Tossed salad (small)	⎯	⎯	⎯	⎯	⎯
Vegetable soup (1 cup)	⎯	⎯	⎯	⎯	⎯
Tomato juice (8oz)	⎯	⎯	⎯	⎯	⎯
V-8 juice (8oz)	⎯	⎯	⎯	⎯	⎯
Other 100% vegetable juice (8oz)	⎯	⎯	⎯	⎯	⎯

Continued on back of page

Cup=c=8oz	Once Per Day	2 or more Per Day	Once Per Week	2 or more Per Week	Did Not Eat This Week
Apple juice (8oz)	___	___	___	___	___
Orange juice (8oz)	___	___	___	___	___
Grapefruit juice (8oz)	___	___	___	___	___
Other 100% fruit juice (8oz)	___	___	___	___	___
Grapes (10)	___	___	___	___	___
Bananas (1)	___	___	___	___	___
Peaches (1)	___	___	___	___	___
Apricots (2 halves)	___	___	___	___	___
Apples (1)	___	___	___	___	___
Pears (1)	___	___	___	___	___
Plums (1)	___	___	___	___	___
Oranges (1)	___	___	___	___	___
Grapefruit (1/2)	___	___	___	___	___
Strawberries (1/2 c)	___	___	___	___	___
Blueberries (1/2 c)	___	___	___	___	___
Raspberries (1/2 c)	___	___	___	___	___
Blackberries (1/2 c)	___	___	___	___	___
Cherries (1/2 c)	___	___	___	___	___
Cantaloupe (1/2 c)	___	___	___	___	___
Watermelon (1/8 melon)	___	___	___	___	___
Honeydew (1/2 c)	___	___	___	___	___
Melons, other (1/2 c)	___	___	___	___	___
Nectarines (1)	___	___	___	___	___
Kiwi (1)	___	___	___	___	___
Tangerines (1)	___	___	___	___	___
Pineapples (1/2 c)	___	___	___	___	___

Cup=c=8oz	Once Per Day	2 or more Per Day	Once Per Week	2 or more Per Week	Did Not Eat This Week
Mangoes (1)	____	____	____	____	____
Coconuts (1/4 c)	____	____	____	____	____
Papayas (1)	____	____	____	____	____
Dates (1oz)	____	____	____	____	____
Raisins (1oz)	____	____	____	____	____
Prunes (1oz)	____	____	____	____	____
Peaches, dried (1oz)	____	____	____	____	____
Apricots, dried (1oz)	____	____	____	____	____
Apples, dried (1oz)	____	____	____	____	____
Bananas, dried (1oz)	____	____	____	____	____
Mixed fruit, dried (1oz)	____	____	____	____	____
Other fruit, dried (1oz)	____	____	____	____	____

Can you think of any other fruit and/or vegetable that you had in the past week that was not on this form? If so, what was it, what was the amount, and how many times did you have it this past week?

Fruit/vegetable_____Amount_____Frequency_____
Fruit/vegetable_____Amount_____Frequency_____
Fruit/vegetable_____Amount_____Frequency_____
Fruit/vegetable_____Amount_____Frequency_____

. . . .

In appreciation for your time, there will be a drawing for two Eskimo Joe's Clothes gift certificates, each in the amount of $25 dollars. If you wish to enter this drawing, please leave the appropriate information in the spaces provided. This entry form will be detached when we receive the completed questionnaire so that names will not be associated with the survey.
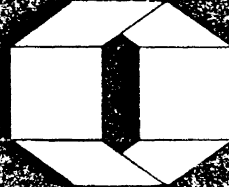
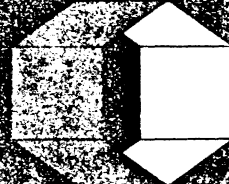**Name** _____

Address _____

Phone _____

APPENDIX B

DIETARY GUIDELINES FOR AMERICANS

Nutrition and Your Health:

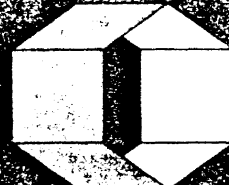# Dietary Guidelines for Americans
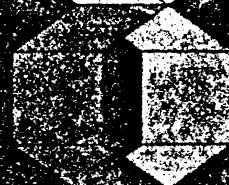
Eat a variety of foods page 5
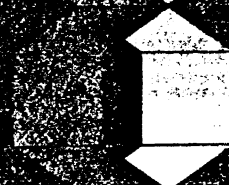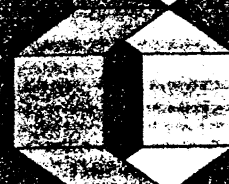
Maintain healthy weight page 8
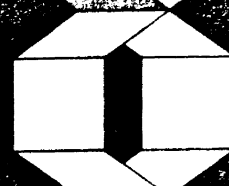
Choose a diet low in fat, saturated fat, and cholesterol page 13

Choose a diet with plenty of vegetables, fruits, and grain products page 18

Use sugars only in moderation page 21

Use salt and sodium only in moderation page 23

If you drink alcoholic beverages, do so in moderation page 25

Third Edition, 1990
U.S. Department of Agriculture
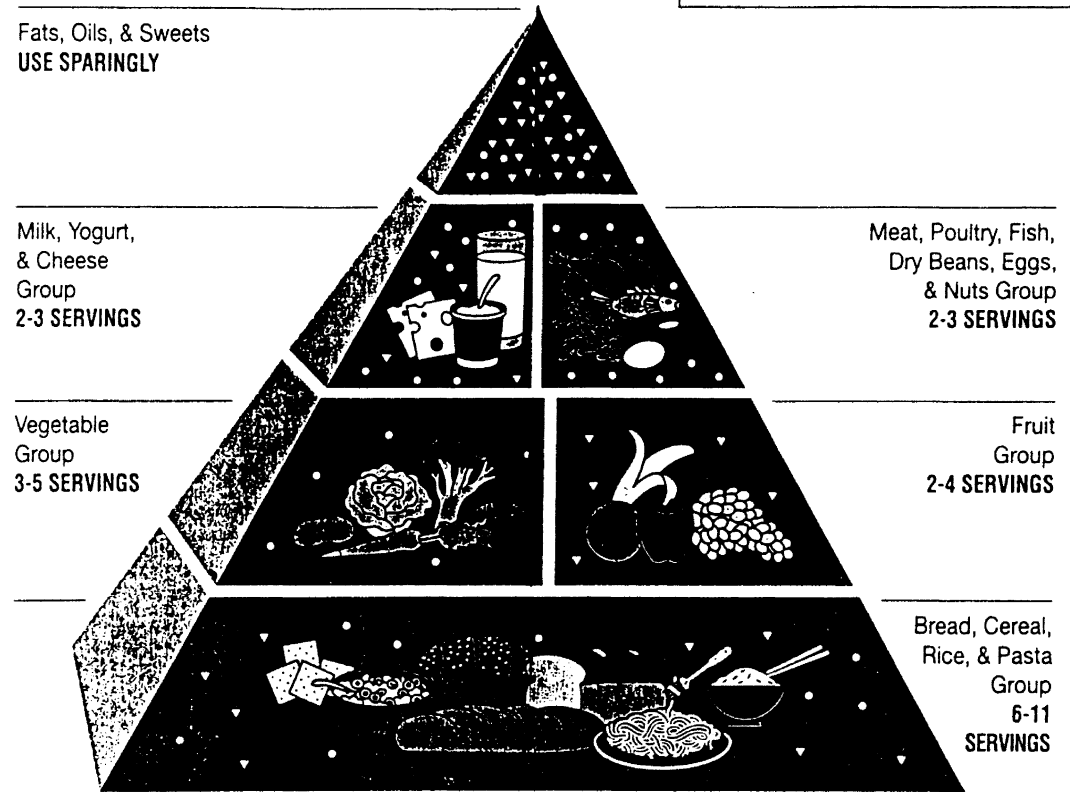U.S. Department of Health and Human Services

APPENDIX C

THE FOOD GUIDE PYRAMID

The Food Guide Pyramid

A Guide to Daily Food Choices

Fats, Oils, & Sweets
USE SPARINGLY

Milk, Yogurt,
& Cheese
Group
2-3 SERVINGS

Meat, Poultry, Fish,
Dry Beans, Eggs,
& Nuts Group
2-3 SERVINGS

Vegetable
Group
3-5 SERVINGS

Fruit
Group
2-4 SERVINGS

Bread, Cereal,
Rice, & Pasta
Group
**6-11
SERVINGS**

What is the Food Guide Pyramid?

The Pyramid is an outline of what to eat each day. It's not a rigid prescription, but a general guide that lets you choose a healthful diet that's right for you.

The Pyramid calls for eating a variety of foods to get the nutrients you need and at the same time the right amount of calories to maintain a healthy weight.

The Pyramid also focuses on fat because most American diets are too high in fat, especially saturated fat.

APPENDIX D

NUTRITION OBJECTIVES FOR YEAR 2000

HEALTH STATUS OBJECTIVES

1. Reduce coronary heart disease to no more than 100 per 100,000 people.

2. Reverse the rise in cancer deaths to achieve a rate of no more than 130 per 100,000 people.

3. Reduce overweight to a prevalence of no more than 20 percent among people aged 20 and older and no more than 15 percent among adolescents aged 12 through 19.

4. Reduce growth retardation among low-income children aged 5 and younger to less than 10 percent.

RISK REDUCTION OBJECTIVES

5. Reduce dietary fat intake to an average of 30 percent of calories or less and average saturated fat intake to less than 10 percent of calories among people aged 2 and older.

6. Increase complex carbohydrate and fiber-containing foods in the diets of adults to 5 or more daily servings for vegetables (including Legumes) and fruits, and to 6 or more daily servings for grain products.

7. Increase to at least 50 percent the proportion of overweight people aged 12 and older who have adopted sound dietary practice combined with regular physical activity to attain an appropriate body weight.

8. Increase calcium intake so at least 50 percent of youth aged 12 through 24 and 50 percent of pregnant and lactating women consume 3 or more servings daily of foods rich in calcium and at least 50 percent of people aged 25 and older consume 2 or more servings daily.

9. Decrease salt and sodium intake so at least 65 percent of home meal preparers prepare foods without adding salt, at least 80 percent of people avoid using salt at the table, and at least 40 percent of adults regularly purchase foods modified or lower in sodium.

10. Reduce iron deficiency to less than 3 percent among children aged 1 through 4 and among women of childbearing age.

11. Increase to at least 75 percent the proportion of mothers who breast-feed their babies in the early post postpartum period and to at least 50 percent the proportion who continue breastfeeding until their babies are 5 to 6 months old.

12. Increase to at least 75 percent the proportion of parents and care givers who use feeding practices that prevent baby bottle tooth decay.

13. Increase to at least 85 percent the proportion of people aged 18 and older who use food labels to make nutritious food selections.

14. Achieve useful and informative nutrition labeling for virtually all processed foods and at least 40 percent of fresh meats, poultry, fish, fruits, vegetables, baked goods, and ready-to-eat carry-away foods.

15. Increase to at least 5,000 brand items the availability of processed food products that are reduced in fat and saturated fat.

16. Increase to at least 90 percent the proportion of restaurants and institutional food service operations that offer identifiable low-fat, low-calorie food choices, consistent with the Dietary Guidelines for Americans.

17. Increase to at least 90 percent the proportion of school lunch and breakfast services and child care food services with menus that are consistent with the nutrition principles in the Dietary Guidelines for Americans.

18. Increase to at least 80 percent the receipt of home food services by people aged 65 and older who have difficulty in preparing their own meals or are otherwise in need of home delivered meals.

19. Increase to at least 75 percent the proportion of the nation's schools that provide nutrition education from preschool through the 12th grade, preferably as part of quality school health education.

20. Increase to at least 50 percent the proportion of worksites with 50 or more employees that offer nutrition education and/or weight management programs for employees.

21. Increase to at least 75 percent the proportion of primary care providers who provide nutrition assessment and counseling and/or referral to qualified nutritionists or dietitians. (DHHS, 1991, pp. 114-127)

VITA

Rebecca S. Plato

Candidate for the Degree of

Master of Science

Thesis: ATTITUDES, KNOWLEDGE, AND CONSUMPTION OF FRUITS AND VEGETABLES
BY COLLEGE STUDENTS

Major Field: Nutritional Sciences

Biographical:

Personal Data: Born in Oklahoma City, Oklahoma, December 21,
1967, the daughter of Frank and Margaret Plato.

Education: Graduated from Edison High School, Tulsa, Oklahoma,
in May 1986; received Bachelor of Science degree from
University of Central Oklahoma in Edmond in December, 1991;
completed the Approved Pre-Professional Practice Program
in May, 1993 at Oklahoma State University; completed the
requirements for the Master of Science degree at Oklahoma
State University in July, 1993.

Professional Organizations: American Dietetic Association and
Oklahoma Dietetic Association.