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FOOD CONSUMPTION PATTERNS AND NUTRIENT INTAKES OF COLLEGE STUDENTS AS AFFECTED BY KNOWLEDGE, ATTITUDES, AND DEMOGRAPHIC FACTORS

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ABSTRACT

Food consumption patterns, nutrient intakes, and food and nutrition knowledge and attitudes were investigated in a sample of college students enrolled in an introductory nutrition course at The University of Tennessee, Knoxville. The sample was divided into subgroups according to responses to questions concerning gender, area of home residence, subscription to a meal plan, year in college, and college major.

Data on food consumption patterns for three days were collected on food record forms, and were based on consumption of foods from 18 food groups during five time periods each day. Food consumption patterns of this college student sample varied among time periods and between genders and were influenced by other independent variables. Percentages of students who did not eat during different time periods varied among these time periods. Percentages of males and females who chose not to eat during each of these time periods were generally similar. Foods from the meat and eggs group, bread group, and fluid milk group were popular choices among both males and females, but foods from all food groups were consumed. Some food groups were chosen more frequently during certain time periods than during other time periods, while consumption from some groups was consistent throughout the day. Percentages of males and females consuming foods from most food groups during specific time periods were similar. But, a higher percentage of males than females consumed food from the fluid milk group during four time periods. Also, differences were found

between percentages of males and females who consumed foods from the meat and eggs, bread, cooked starchy vegetable, and alcoholic beverage groups during at least one time period. For the total day, males consumed at least one more serving from the meat and eggs group and fluid milk group than did females. The following independent variables: area of home residence, subscription to a meal plan, and year in college were related to the number of servings consumed from at least one of five composite food groups, similar to the USDA's Five Food Groups.

The diets of the college students in this sample were generally adequate, with a few exceptions. Males and females recorded mean kilocalorie intakes of 95% and 80% of the Recommended Dietary Allowances (RDA), respectively. Many female college students reported iron intakes below 2/3's of the RDA. The mean intake of calcium for female college students also was below the RDA. Males consumed larger amounts and higher percentages of the RDA for energy and most nutrients than did females. Similar percentages of the RDA were consumed for vitamin A. Males had a higher dietary score than did females, indicating the greater adequacy of their diets.

Food and nutrition knowledge scores of the college student sample denoted a low level of nutrition knowledge. A positive relationship was found between food and nutrition knowledge scores and food and nutrition attitude scores. No relationship between knowledge or attitude scores and dietary score was found.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
II.	REVIEW OF LITERATURE	4
	Meal Skipping	4
	Types and Amounts of Foods Consumed	6
	Food Preferences	9
	Nutrient Intake	11
	Nutrition Knowledge and Attitudes	15
	Food Categorization	17
	Summary	20
III.	METHODOLOGY	21
	Sample Selection	21
	Data Collection	21
	Data Analysis	24
IV.	RESULTS AND DISCUSSION	29
	Sample Characteristics	29
	Eating Occasion Characteristics	33
	Food Consumption Patterns	36
	Nutrient Intakes	50
	Dietary, Knowledge, and Attitude Scores	60
V.	SUMMARY AND CONCLUSIONS	64
	Limitations of the Study	68
	Implications of the Study	68
BIBLIOGRAPHY		71
APPENDICES		77
	Appendix 1	78
	Appendix 2	80
	Appendix 3	87
	Appendix 4	89
	Appendix 5	91
	Appendix 6	93
	Appendix 7	102
	Appendix 8	109
VITA		111

LIST OF TABLES

TABLE		PAGE
1.	Demographic Characteristics of College Student Sample. . .	30
2.	Educational Characteristics of College Student Sample. . .	31
3.	Residence Characteristics of College Student Sample. . . .	32
4.	Financial and Family Characteristics of College Student Sample	34
5.	Eating Occasion Characteristics of College Student Sample	35
6.	Percentages of Male and Female Students Who Did Not Report Food Consumption During Various Time Periods of Three Days.	37
7.	Mean Percentages of Males and Females Who Chose at Least One Food from Each Food Group During 5 Time Periods.	38
8.	Least Squares Means of Number of Servings Consumed Daily by Male and Female College Students.	42
9.	Least Squares Means of Number of Servings Consumed Daily from Five Composite Food Groups by Male and Female College Students	44
10.	Least Squares Means of Number of Servings Consumed Daily from Five Composite Food Groups by College Students from Three Areas of Home Residence.	45
11.	Least Squares Means of Number of Servings Consumed Daily from Five Composite Food Groups by Meal Plan Participants and Non-Participants.	47
12.	Least Squares Means of Number of Servings Consumed Daily from Five Composite Food Groups by Freshman, Sophomore, Junior, and Senior College Students	48
13.	Least Squares Means of Number of Servings Consumed Daily from Five Composite Food Groups by Home Economics and Non-Home Economics Majors.	49

TABLE PAGE

14. Least Squares Means of Energy and Nutrient Intakes of Male and Female College Students. 52

15. Least Squares Means of Energy and Nutrient Intakes of College Students from Three Areas of Home Residence. 56

16. Least Squares Means of Energy and Nutrient Intakes of Meal Plan Participants and Non-Participants 57

17. Least Squares Means of Energy and Nutrient Intakes of Freshman, Sophomore, Junior, and Senior College Students 58

18. Least Squares Means of Energy and Nutrient Intakes of Home Economics Majors and Non-Home Economics Majors 59

19. Least Squares Means of Dietary, Knowledge, and Attitude Scores of College Student Sample. 61

CHAPTER I

INTRODUCTION

A high level of variability in food consumption patterns among college students has been reported. This variability can lead to inadequacies or excesses in the diets of college students, and problems in supplying appropriate foods in adequate amounts for consumption by college students. As a result, food consumption patterns of college students are of special interest to nutrition educators, college food service managers, and food producers. Although many researchers studied types of foods consumed and times of eating occasions, there have been few studies in which these two factors have been investigated simultaneously with socio-demographic data.

The tendency of college students to skip meals has resulted in inconsistency in the number of meals consumed per day (Gottschalk et al., 1977; Haseba and Brown, 1968; Jakobovits et al., 1977). Several investigators have reported large differences in amounts and types of foods eaten by male college students compared with those eaten by female college students (Einstein and Hornstein, 1970; Gottschalk et al., 1977). Avoidance of specific foods and groups of foods by many college students contributed to the variability that was displayed in their food consumption patterns (Einstein and Hornstein, 1970; Jakobovits et al., 1977; Schuck, 1969; Stasch et al., 1970).

Because nutrient intake is a function of food consumed, inconsistency in food consumption patterns may lead to inadequate intakes

of one or more nutrients. Inadequacy of iron intake by female college students has been reported repeatedly (Chilson and Knickrehm, 1973; Driskell et al., 1979; Jakobovits et al., 1977; Ostrom and Labuza, 1977; Wise and Fuqua, 1974). Low intakes of other nutrients have been reported, but to a lesser degree than for iron (Jakobovits et al., 1977; Stordy, 1973; Wise and Fuqua, 1974). Energy consumption was found to be less than recommended amounts for female college students by Jakobovits et al. (1977) and for both male and female college students by Gottschalk et al. (1977). Males' nutrient intakes were adequate more often than were females' intakes due to the larger amounts of food consumed by males (Driskell et al., 1979; Stordy, 1973; Wise and Fuqua, 1974).

Food consumption patterns and, thus, nutrient intakes of college students were reported to be influenced by the new lifestyles and situations the students encountered on the college campus (Brown, 1967; Driskell et al., 1979; Wakefield and Miller, 1971). Even though the students were in environments that were very different from their home environments and were influenced easily, their food consumption patterns still reflected personal and cultural background (Brown, 1967; Mills, 1977). Also, food and nutrition knowledge and attitudes formed a basis for food-related decisions and affected food consumption patterns and nutrient intakes (Werblow and Fox, 1978).

In order to ensure a comprehensive view of food consumption patterns of college students, the patterns themselves, factors influencing the patterns, and nutrient intakes should be investigated.

Food consumption patterns include times of consumption and types and amounts of foods consumed. Such studies could be very useful in improving food and nutrition education programs, in setting up college food service operations, and in revealing to food producers what foods college students are consuming. Thus, this study was designed to provide descriptive information about food consumption patterns of college students, their nutrient intakes, and their knowledge and attitudes about food and nutrition. The effects of selected demographic factors on food consumption patterns, nutrient intakes, and food and nutrition knowledge and attitudes were studied. Interrelationships among selected variables also were considered.

CHAPTER II

REVIEW OF LITERATURE

Food consumption patterns of college students have been reported in many different ways. Studies of meal skipping patterns, types and amounts of foods consumed, food preferences, and nutrient intakes can be found in the literature. The effects of demographic factors and food and nutrition knowledge and attitudes on food consumption patterns have been reported also. Food categorization systems have been developed for a variety of uses, such as nutrition guidance and evaluation of food consumption patterns.

Meal Skipping

Many college students do not follow a "typical" food consumption pattern of three meals-a-day. Thus, meal skipping patterns of college students are of interest and have been studied by many researchers.

The breakfast meal was found to be the meal that was skipped most often by college students (Brown, 1967; Gottschalk et al., 1977; Guild et al., 1972; Lamb, 1954; Wakefield and Miller, 1971). Wise and Fuqua (1974) reported that 60% of students studied at Purdue University skipped breakfast. In another study, the noontime meal was identified as the meal most often skipped (Jakobovits et al., 1977), with 69% of students missing it one-five times per week. Both Jakobovits et al. (1977) and Brown (1967) found the evening meal to be the least skipped.

Many factors were reported to affect the phenomenon of meal skipping among college students. Male college students were found to skip breakfast more regularly than did women (Haseba and Brown, 1968; O'Leary and Lee, 1975). Haseba and Brown (1968) also reported that men followed the same pattern of breakfast consumption throughout the whole week, but women who ate breakfast on class days often skipped breakfast on weekends.

In Haseba and Brown's (1968) research, those women who skipped breakfast on weekends did not have these meals prepaid on a food service contract and did not make the effort to pursue a breakfast meal elsewhere. Apparently this behavior was carried over to the other days of the week as well, because if students were on the prepaid meal plan they were more likely to eat breakfast regularly than did those students not on a prepaid meal plan. This result was attributed to the convenience, absence of direct expenditure of money, and efficient use of time associated with procurement of breakfast through a prepaid meal plan. On the contrary, O'Leary and Lee (1975) indicated a tendency for students on a meal plan to skip breakfast more often than did those not on a meal plan. Gottschalk et al. (1977) and O'Leary and Lee (1975) reported that those students with a meal contract tended to miss more meals than did those without a meal contract.

Several other influences on meal skipping patterns among college students have been identified. Even though college students lived away from home, Stasch et al. (1970) found that breakfast patterns of college students were influenced by their mother's breakfast preparation practices. If the mother had prepared breakfast while the

student was at home, there was an increased tendency for the college student to be a breakfast consumer. These researchers also reported that lunch consumption and enjoyment of breakfast were related. Those students who enjoyed eating breakfast ate a substantial lunch more often than did those who were not willing breakfast consumers.

Breakfast skipping was related also to body weight (Wakefield and Miller, 1971). In the reported study, 70% of the overweight women skipped breakfast compared to 35% of the average weight women and 9% of the underweight women.

Brown (1967) reported that length of time in college was related also to meal skipping patterns among college students. While 34% of freshmen college students skipped breakfast, only 23% of the upperclassmen skipped this meal. Other factors encountered at college that influenced meal skipping patterns were stress, the absence of a definite lunch period, and peer influence (Brown, 1967; Jakobovits et al., 1977).

Types and Amounts of Foods Consumed

In recent years, interest in the diversity of college students' diets has increased. This increased interest has led to research concerning the types and amounts of foods consumed by college students. A small number of studies have been done in which factors influencing the types and amounts of foods consumed by college students were investigated.

The consumption of dairy products by college students was researched by Stasch et al. (1970). They reported that 1/3 of the

students studied at New Mexico State University drank milk at least once a day. When Wakefield and Miller (1971) studied milk consumption among female college students, 25% said they never drank milk. Kahn (1980) reported that milk and cola beverages were chosen more often by college men and women than were other beverages.

Parham and Parham (1980) stated that the usual weekly consumption of sweets by college students averaged 28.0 servings. An average consumption of 2.8 servings of regular carbonated beverages per week plus 2.0 servings of other types of sugar-sweetened beverages was reported. Calkins (1979) reported that male college students consumed more sugar-sweetened carbonated beverages than did female college students. Use of saccharin, a common ingredient in diet soft drinks, was investigated by Parham and Parham (1980). This investigation indicated that 50% of the male college students did not use saccharin compared to only 23% of the females. Calkins (1979) also found that females used more low calorie soft drinks than did males.

The types and amounts of foods consumed related to gender of the individual have been reported by other researchers as well. Werblow and Fox (1978) studied women athletes at the University of Nebraska and found that they generally ate beef, fruit, citrus fruit juices, green salads, milk, hamburger, poultry, and yellow and green vegetables. Female college students taking part in research studies by Wakefield and Miller (1971) reported increased consumption of fish and eggs at the university compared to consumption at home. Male

college students were found by Calkins (1979) to consume more beef than did female college students.

Subscription to a meal plan was investigated as a factor influencing types and amounts of foods consumed by college students. Results showed that women without a meal contract ate more fruits and vegetables and drank less milk than did those with a meal contract (Gottschalk et al., 1977). In the same study, male college students with a meal contract consumed smaller portions of meat than did those without meal contracts.

Budgetary concerns sometimes may cause exclusion of foods from the diet. Jakobovits et al. (1977) reported that some college students avoided purchasing and consuming beef, shellfish, asparagus, and artichokes because they considered them too expensive.

College students studied by Jakobovits et al. (1977) excluded many foods from their diet because of health concerns. Foods most frequently excluded were sweets, carbonated beverages, white bread, highly processed foods, snack-type foods, and eggs. These findings are very similar to those reported by Jones and Weimer (1981). In their study, reduction in consumption of the previously mentioned foods was attributed to concerns about excess sugar, weight control, blood pressure control, fat and cholesterol intake, and food safety.

Wakefield and Miller (1971) found a relationship between weight of female college students and types and amounts of some foods consumed. When food consumed by average weight, underweight, and overweight females was monitored, the average weight group consumed the least food of the three groups. The women who were classified as

overweight avoided coffee and alcoholic beverages to a greater degree than did the other two groups. Brown (1967) reported that college students felt that students from farms exhibited larger appetites than did students from urban areas.

Food Preferences

In many cases, food preferences have been used to study the food consumption patterns of college students. Food preferences do not automatically lead to food acceptance and/or food consumption. However, food preference is associated closely with food acceptance (Calkins, 1979) and can be used as an indicator of types of foods that if available are likely to be consumed by college students.

Reports of preferences for food groups provide a general picture of what college students prefer to consume. Einstein and Hornstein (1970) reported that the bread group was the most popular, followed by the beverage group. Desserts, as a group, were well represented on a "most liked" list, but none were found on a "most disliked" list. Vegetables did not appear on a "most liked" list, but a "most disliked" list contained numerous vegetables. Of all vegetables, corn was the most frequently liked vegetable, with 90% of the South Dakota college students indicating they would accept it frequently (Schuck, 1969). Other groups of foods found to be disliked were soups (Einstein and Hornstein, 1970) and organ meats (Schuck, 1969; Wise and Fuqua, 1974).

Wise and Fuqua (1974) reported that milk was among the "most liked" foods of college students at Purdue University. Likewise,

milk was among the most preferred breakfast foods when Stasch et al. (1970) questioned college students. Milk was one of three beverages most preferred for snacks as reported by Nelson and King (1982).

Along with these general findings of likes and dislikes, factors influencing food preferences were investigated and reported. Some foods were more preferred by one gender than by the other gender. Schuck (1969) stated that female college students were more willing to eat fruit than were male college students. In that study, male college students exhibited a greater willingness to eat meat than did female college students.

Female college students were thought to enjoy low calorie foods more than were men. Einstein and Hornstein (1970) supported this thought when they reported that female college students showed a greater preference for salads and vegetables than did their male counterparts. Cabbage and broccoli were liked by a greater percentage of female than by male college students. These findings did not agree with those of Schuck (1961), who showed that men at South Dakota State University exhibited more willingness to eat vegetables than did women.

Regional differences in types of foods preferred by college students were documented by Schuck (1969) and Einstein and Hornstein (1970). The greatest regional differences were found in the South where grits, black-eyed peas, lima beans, turnip greens, and iced tea were among the most preferred foods. Along with regional differences, urban and rural influence was investigated. Urban students exhibited higher acceptance levels for most foods than did rural students.

Nutrient Intake

The most prominent factor influencing nutrient needs of college students is gender of the individual. Energy and iron intakes of female college students have appeared as problem areas consistently in research reports. When Young and Storvick (1949) studied freshmen at Oregon State College, men generally had better diets than did women. This trend has continued to the present (Ostrom and Labuza, 1977; Stordy, 1973).

Conflicting results have been reported concerning energy consumption of college students. In a summary of various studies, Stordy (1973) stated that both men and women consistently consumed less than the Recommended Dietary Allowances (RDA) for energy. Again, results were more encouraging for males than for females. In agreement with Stordy's opinion, Gottschalk et al. (1977) reported that 80% of women and 60% of men had inadequate energy intakes. A 24-hour diet composite of college women at Northwestern University indicated that these female college students were consuming an average kilocalorie (kcal) intake of 1,467±336 (White, 1968). Jakobovits et al. (1977) reported an average kilocalorie intake of 1,930 kcals per day for female college students, 92% of the RDA for energy. Driskell et al. (1979) disagreed with reports of inadequate intakes of kilocalories and stated that men consumed significantly more kilocalories than did women, but energy intakes were adequate for both male and female college students.

Gottschalk et al. (1977) carried out an analysis of kilocalorie distribution among protein, fat, carbohydrate, and alcohol. Percentages

of kilocalories provided by these nutrients were 15, 37, 44 and 4%, respectively. Walker and Page (1976) studied meals served by 50 college food services. The meals analyzed contained a mean fat content of 126 g per day. This amount of fat furnished a mean of 42% of the total daily kilocalorie intake. Ostrom and Labuza (1977) reported among college students studied at the University of Minnesota that 36% of kilocalories consumed per day were provided by fat.

The major concern about nutrient intakes among college students is the consistent inadequacy of iron intake by female college students. This concern pertains more specifically to female than to male college students because males have been shown to consume adequate amounts of iron (Driskell et al., 1979; Gottschalk et al., 1977; Ostrom and Labuza, 1977). Guild (1972) reported that meals selected by college students from a South Dakota State University cafeteria met the RDA for all nutrients except iron intakes by women. Diets of female college students were characterized by low iron intakes when Jakobovits (1977) studied junior and senior female students at Cornell University. Female college students in Canada also were reported to follow the trend toward iron intakes below recommended levels (Gottschalk et al., 1977).

Reported values for these low iron intakes of female college students ranged from 8.92 to 13.1 mg/day (Driskell et al., 1979; Gottschalk et al., 1977; Jakobovits et al., 1977; White, 1968; White, 1969). Jakobovits et al. (1977) reported an average iron consumption of 69% of the RDA compared to an average iron consumption of 56% of the RDA found by Ostrom and Labuza (1977). These values were

not distorted by skewed results; low intakes were common throughout the samples. As many as 93% and 61% of the female respondents in one study had iron intakes below 80% and 60% of the RDA, respectively (Ostrom and Labuza, 1977).

Calcium is another mineral that presents problems in nutrient intakes of college students. Research results are divided as to whether or not college students receive adequate amounts of calcium from their diets. Ostrom and Labuza (1977) reported that a substantial number of both male and female college students had intakes of calcium below 80% of the RDA. White (1968) showed that the average female college students' intake of calcium was 733 mg/day, which is below the present RDA of 800 mg/day (FNB, 1980). In a study by Wise and Fuqua (1974), 91% of college students recorded calcium intakes above 2/3's of the RDA. Results reported by Gottschalk et al. (1977) showed both male and female college students' calcium intakes to be above the RDA. In support of this, Jakobovits et al. (1977) reported an average daily intake of 862 mg calcium per day or 108% of the RDA by female college students. Adequate amounts of calcium were present in college food service meals when they were analyzed by Walker and Page (1977).

Reported intakes of vitamin A by college students were skewed extremely (Ostrom and Labuza, 1977). Even though the average intake was very close to the RDA, 1/3 of the subjects in this study received less than 60% of the RDA. In similar results reported by Wise and Fuqua (1974), only 55% of subjects had 2/3's of the RDA. Jakobovits et al. (1977) found no apparent problem with vitamin A consumption

by female college students because the mean intake was 171% of the RDA. When Walker and Page (1975) analyzed meals served by college food service establishments, each service provided meals with more vitamin A than the RDA.

College students' intakes of protein, thiamin, riboflavin, and niacin were found to be adequate by many researchers (Driskell et al., 1979; Gottschalk et al., 1977; Jakobovits et al., 1977; Ostrom and Labuza, 1977; Wise and Fuqua, 1974). Men consumed significantly more of these nutrients than did women (Driskell et al., 1979). In all research reviewed, average consumption values of ascorbic acid were very high, some reaching values above 200% of the RDA (Driskell et al., 1977; Gottschalk, et al., 1977; Jakobovits et al., 1977; Ostrom and Labuza, 1977; Wise and Fuqua, 1974). Ostrom and Labuza (1977) showed ascorbic acid consumption values to be skewed, thus 10% of subjects still had intakes below 80% of the RDA even though the average consumption was 219% of that standard.

In general, the diets of college students are similar to those of 19-22 year olds in the general population (USDA, 1980). In the Nationwide Food Consumption Survey 1977-1978 (NFCS) researchers reported a kilocalorie distribution of 17% of kilocalories from protein for both males and females, 41% from fat for both males and females, 41% from carbohydrate for males and 42% from carbohydrate for females, and 1-2% of the kilocalories from alcohol. These values are comparable to those reported by Gottschalk et al. (1977). The NFCS researchers (USDA, 1980) also reported iron intakes for females at 10.7 mg per day, comparable to the intakes of college students reported by many researchers

(Driskell et al., 1979; Gottschalk et al., 1977; Jakobovits et al., 1977; White, 1968; White, 1969). The other major nutrients were consumed at levels above the RDA by both male and female 19-22 year olds (USDA, 1980).

Nutrition Knowledge and Attitudes

Knowledge and attitudes are interrelated factors that also are related to practices (Cunningham et al., 1981). Many college students have a limited understanding of nutrition concepts. Incomplete knowledge may lead to poor food-related decisions (Gifft, 1972). These weaknesses in knowledge need to be identified in order to improve programs of nutrition education (Haas, 1980). Knowledge is only one component that may affect food-related decisions. Attitudes are "dispositions toward stimuli" and result in a "tendency toward action" (Gifft, 1972). But, it cannot be assumed that increased nutrition knowledge results in a change in attitudes and finally in an improvement in food-related practices.

Researchers found that college students had limited nutrition knowledge and many misconceptions (Cho and Fryer, 1974; Lindamood and Gunning, 1977; Toma, 1974; Werblow and Fox (1978). Calkins (1979) found similar results when other young adults were studied. Werblow and Fox (1978) studied college athletes and reported that they had many misconceptions about organic and natural foods and about the roles of carbohydrate and protein-rich foods. Of students who were surveyed by Lindamood and Gunning (1977), only 69% could name the Four Food Groups.

Some comparisons of nutrition knowledge and misconception scores of male and female college students have indicated significant differences in these scores. Alexander (1978) distributed a nutrition quiz to junior and senior college students. Female non-home economics majors scored significantly higher than did male non-home economics majors. When Cho and Fryer (1974) tested college physical education majors' nutrition knowledge, the mean score of females was significantly higher than was the mean score of males. On the contrary, males and females scored similarly on nutrition knowledge tests used by Toma (1974) and by McCarthy and Sabry (1973).

College students who had taken home economics in secondary school had fewer misconceptions than did those without secondary school home economics instruction (McCarthy and Sabry, 1973). Schwartz (1975) studied high school graduates and found that secondary school home economics instruction and nutrition knowledge scores were not related consistently. Alexander (1978) found that members of a home economics honor society had significantly higher nutrition knowledge scores than did non-home economics students. No relationship between urban or rural background and misconception scores was found (McCarthy and Sabry, 1973).

Measurement of attitudes about nutrition has provided data concerning these attitudes and their relationship with nutrition knowledge (Kahn, 1981). Positive attitudes toward nutrition and the relationship of good eating habits to good health were found among college athletes (Werblow and Fox (1978). No consistent association was found between previous home economics instruction and attitude scores

by Schwartz (1975). Sims (1976) and Grotkowski and Sims (1978) reported significant relationships between nutrition knowledge and the attitude that "nutrition is important." This was substantiated in work with college students by Werblow et al. (1978), in which nutrition knowledge and attitudes were positively correlated.

As previously stated, a change in knowledge and attitudes about nutrition does not result necessarily in a change in dietary practices. Jalso et al. (1965) did find that nutrition opinions were correlated with nutrition practices. But, no correlations between nutrition knowledge and dietary practices or adequacy of the diet were found by Schwartz (1975), Alexander (1978), or Wise and Fuqua (1974).

Food Categorization

There have been many different methods devised for categorization of foods. These various methods resulted from the need for systems that fit many different purposes. Categorization systems have been designed as nutrition guides for individuals, as aids in planning meals for families or institutions, and as a means of investigating food consumption patterns.

Simplicity was strived for when food categorization systems were developed for use as nutrition guides by the consumer. The Basic Seven, a categorization system introduced by the Agricultural Research Administration of the U. S. Department of Agriculture in 1943 (Hayes et al., 1955), included groups for milk products; meat products; bread products; butter and fortified margarine; citrus fruits,

tomatoes, and cabbage; dark-green and deep-yellow vegetables; potatoes and other vegetables and fruits (Vail, 1978). Hayes et al. (1955) proposed that a two division system of food categorization could fulfill the needs for a nutrition guide. The system suggested included a group of high energy foods and another group labeled protective foods. This food categorization system stressed the need for a balance between nutrient dense foods (protective foods) and high energy foods in the diet (Hayes et al., 1955).

The most frequently used food categorization system is the Four Food Groups. This system was developed in the mid 1950's by the USDA (1956) as a flexible nutrition guide that, if followed, would ensure "desirable levels of nutritional attainment" (Light and Cronin, 1981). The Four Food Groups guide includes the milk group, meat group, vegetable and fruit group, and bread and cereal group. The foods were categorized according to contribution of the foods to health and well-being (Vail, 1978).

The idea of a fifth food group was incorporated into the USDA's Daily Food Guide (USDA, 1979). This fifth group includes high energy foods such as fats, sugars, and alcohol. Another food group system was proposed by Pennington (1981). This system also contains a group labeled "luxury foods" that includes desserts, fats, sweets, and alcohol.

The Handy Five, a categorization system for use as a nutrition guide, was proposed by Dodds (1981). Foods were divided into five groups defined as fruit (flesh around seeds); vegetables (leaves, stalks, roots, and flowers); grains (seeds on grasses); nuts and

legumes (seeds in pods); and dairy, eggs, and meat (animal products).

As the purpose of the categorization system changes so does the format. The systems developed for meal planning and for characterization of food consumption were more complex. This was due to the addition of and increase in specificity of food groups.

The USDA developed a food guide with eleven categories for use in planning institutional menus (Hayes et al., 1955). Another group plan called the Family Food Plan includes the following groups: milk, cheese, ice cream; meat, poultry, fish; eggs; dry beans, peas, nuts; flour, cereals, baked goods; citrus fruit, tomatoes; dark-green and deep-yellow vegetables; potatoes; other fruits and vegetables; fats and oils; and sugars and sweets (USDA, 1970). This system has been used by the Consumer and Food Economics Research Division of the USDA as a family meal planning guide (Vail, 1978).

As a part of the Ten-State Nutrition Survey (DHEW, 1972) frequency of usage of food items was studied. In this survey, food categories included were milk; poultry; fish; mixed meat, fish, and poultry dishes; meats; eggs; cheese and cheese dishes; soups; beans, nuts, and mature peas; cereals, and grain products; vegetables and fruits high in ascorbic acid; vegetables high in vitamin A; pastries and other desserts; jams, jellies, and candies; beverages; and snack foods. A similar grouping system was used by USDA researchers in a recent investigation of individual food consumption patterns (Pao et al., 1982).

Summary

Food consumption patterns of college students have been measured in various ways. Regardless of the method used, findings indicate variability. Influence of selected factors on these food consumption patterns account for a portion of the variability.

Nutrient intakes of college students have been shown to be adequate for many nutrients. Iron intake of females is identified in the literature as the most prominent nutrient intake problem.

Food and nutrition knowledge among college students is limited. Nutrition knowledge seems to be related to attitudes, but no relationship was found between knowledge and dietary practices.

Food categorization systems have been used for many years as nutrition guides. Recently, food categorization systems have been used successfully for research of food consumption patterns of individuals.

CHAPTER III

METHODOLOGY

Sample Selection

College students who were enrolled in Nutrition 1230 during the winter, spring, summer, and fall quarters of 1980 were eligible to take part in this study. Nutrition 1230 is an introductory nutrition course with no prerequisites. This course is taught every quarter and is taken by students from all colleges at The University of Tennessee, Knoxville.

As a class project, students were required to complete a three-day food record, nutrient calculations of the food they consumed for those three days, and a food and nutrition knowledge and attitude pretest and posttest. Only those students who completed all portions of the project, a voluntary consent form (Appendix 1) and a demographic questionnaire were included in this study. Three hundred forty-seven students completed the course during the duration of the study. After eliminating from the sample those students who did not complete all portions of the study, the final number of students participating in the study was 303.

Data Collection

Pilot Testing

All questionnaires, forms, and tests used in this study were administered to Nutrition 1230 students during fall quarter 1979

as a pilot test. Forms were revised where needs for change were indicated. All forms and methods were approved by the University's Committee on Research Participation.

Demographic Data

Demographic Data Forms (Appendix 2) were distributed to those students who agreed to participate in the study. Questions concerning personal, residence, financial, family, educational, and eating occasion characteristics were included in the questionnaire. The forms were designed to provide descriptive information about the sample and to allow delineation of the sample into sub-groups. The forms were completed and collected at the beginning of each quarter.

Food Records

Early in each quarter, students were given a three-day Food Record Form (Appendix 3), a revised version of one used by Skinner (1978). Each day was divided into the following five time periods: Before 10:00 A.M., 10:00 A.M.-2:00 P.M., 2:00 P.M.-5:00 P.M., 5:00 P.M.-8:00 P.M., and After 8:00 P.M.

Students were instructed to record food consumption for a specific Thursday, Friday, and Saturday. Instructions on how to estimate serving sizes were given to the class by the instructor. Students were directed to record all food consumed during the time periods in the corresponding blocks, along with amounts and descriptions of the foods.

Nutrient Intakes

In conjunction with the Food Record Form, three Daily Nutrient Record Forms (Appendix 4) were distributed. Each student recorded nutrient amounts provided by foods consumed and calculated daily totals for energy, protein, fat, carbohydrate, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid on the Daily Nutrient Record Forms. The values of nutrients supplied by foods were obtained from Home and Garden Bulletin No. 72 (USDA, 1977). The students then transferred the daily totals to the Summary Nutrient Intake Form (Appendix 5), where mean intakes for three days, percentages of the RDA (FNB, 1980) and percentages of kilocalories consumed provided by protein, fat, carbohydrate, and alcohol were calculated.

Students' nutrient calculations were checked by a graduate teaching assistant. Calculations were checked again by the class instructor as projects were graded. Finally, for this study, an extensive check of the calculations was carried out by the investigator and research assistants.

The Summary Nutrient Intake Form was designed so that major errors could be detected easily through checks that were built into the form. The number of kilocalories consumed was calculated by two methods. The results of these two methods had to match within 100 kcals. If a difference of greater than 100 kcals was found, more detailed checking of calculations was done. Percentages of kilocalories provided by protein, carbohydrate, fat, and alcohol

were summed and the total had to be accurate within 5% in order to be judged correct. Discrepancies were investigated and calculations were corrected consistent with the raw data provided by the student.

Knowledge and Attitude Pretests and Posttests

At the beginning of each quarter, the Food and Nutrition Knowledge and Attitude Pretest (Appendix 6) was distributed, completed, and collected. The nutrition knowledge portion of the pretest consisted of 40 multiple-choice questions. The questions were revised for use with college students from a teacher nutrition knowledge test used by Skinner (1978). The food and nutrition attitudes portion of the questionnaire was adapted from existing instruments developed by Carruth and Anderson (1977), Salvetti (1982) and Sims (1976). It consisted of 29 questions answered on a five-point response scale of "Strongly Agree" to "Strongly Disagree." An identical questionnaire was distributed, completed, and collected as a Food and Nutrition Knowledge and Attitudes Posttest at the end of each quarter.

Data Analysis

Demographic Data

Frequencies of responses were tabulated and percentages calculated. Demographic responses were used to divide the sample into sub-groups.

Food Records

In conjunction with the food record, a scoring method based on food groups was devised. This method was developed as a means of

evaluating the types and amounts of foods consumed, and when these foods were eaten. The food categories in this scoring method included milk products, meat, legumes, fruit, raw vegetables, cooked starchy vegetables, cooked other vegetables, breads, cereals, pasta, desserts, salty snacks, fluid milk, fruit and vegetable juices, tea and coffee, alcoholic beverages, carbonated beverages, and other beverages. Additional categories included were total daily servings of added fat and added sugars. This system was developed after a review of categorization systems used in other studies (Calkins, 1979; DHEW, 1972; DHEW, 1974; Dodds, 1981; Hayes, 1975; Light and Cronin, 1981; Pennington, 1981; USDA, 1982; Vail et al., 1978). A subjective review of the food records also indicated appropriate food groups for inclusion in the system. A trial of the scoring system was carried out on a sample of the Food Record Forms. A listing of foods included in the groups is shown in Appendix 7.

Information about the number of servings consumed in each food group was tabulated. The USDA Daily Food Guide (USDA, 1967) and Home and Garden Bulletin No. 72 (USDA, 1977) were used to help decide on the appropriate amount to be considered a "serving." Upper and lower limits for one serving were chosen, e.g. pasta: 1 serving $\geq$1/2C and <2C. The upper ranges were used to calculate higher numbers of servings by increasing in intervals the size of the upper limits. The ranges used can be found in Appendix 7. Values indicating the number of servings consumed were entered into

the respective blocks for time and food category. The final Food Group Scoring Form appears in Appendix 8.

In this study a food consumption pattern was defined as consistency of choice of foods from food groups by this sample. This degree of consistency was measured as the percentage of students who chose to consume at least one serving of a food from a food group. A value of one was given if a student chose at least one serving of any food from a food group. A zero was given if no food from the food group was consumed during a time period. The percentage of subjects who chose to consume a food from a food group during each time period was calculated.

The number of servings consumed from each of the 18 food groups was calculated. The 18 food groups, total servings of added fats, and total servings of added sugars were collapsed into 5 more general groups for further analysis: Dairy, Meat, Fruit and Vegetables, Grain, and Other. Number of servings consumed from these groups also were calculated.

Nutrient Intakes

Mean nutrient intakes and mean percentages of the RDA provided by the foods consumed during the three-day food record were calculated for kilocalories, protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin, and ascorbic acid for both males and females. Mean intakes and percentages of kilocalories provided by protein, carbohydrate, fat, and alcohol also were calculated.

A dietary score was obtained based on the percentage of the RDA consumed for each of eight nutrients and energy. If the respondent consumed 2/3's of the RDA for a nutrient, a value of two was given; if less than 2/3's of the RDA but more than 1/3 of the RDA was consumed a value of one was given; less than 1/3 of the RDA consumed resulted in a value of zero (Skinner, 1978). A maximum score of 18 was possible. Mean dietary scores for males and females were calculated.

Knowledge Scores

Nutrition knowledge scores were calculated by giving a value of one for each correct response to a question and 0 for an incorrect response; values were summed. The maximum possible score was 40 points. Mean knowledge scores for males and females were obtained.

Attitude Scores

The attitude portion of the pretest consisted of 29 questions answered on a five-point Likert-type scale. The values assigned to subjects' responses were summed to obtain the nutrition attitude score. The maximum possible score was 145 points. Mean attitude scores for males and females were obtained.

Statistical Analysis

Statistical analysis of the data was conducted using Statistical Analysis System (SAS) 79.5 (SAS Institute, 1979; SAS Institute, 1978), General Linear Model Procedure (PROC GLM). The effects of the variables gender, area of home residence, subscription to a meal plan, year in college, and college major of students on nutrient

intakes, food group consumption, and knowledge and attitude scores were tested with least squares analysis of variance, Type III sums of squares. This method was used because of disproportional sizes of subgroups in this sample (SAS, 1979; SAS, 1981). All pairs of least squares means within each variable were tested for differences.

Percentages of students choosing to consume foods from each of eighteen food groups throughout the day were obtained. Differences between genders were tested by Chi-square analysis using the frequencies represented by the percentages.

Spearman's rank correlation was used to determine relationships among the knowledge scores, attitude scores, and dietary scores. Spearman's rank correlation was chosen because, generally, scores of the type used here do not meet the requirements of a higher level of measurement than rank or ordinal measurement (Seigel, 1956).

CHAPTER IV

RESULTS AND DISCUSSION

Sample Characteristics

The college student sample consisted of 303 students who completed all parts of the study, an 87% completion rate. The sample was 19% male and 81% female (Table 1). Many of the students, 72%, were between the ages of 19 and 22 years. Almost all the students in the sample were white, with a small percentage of black and Asian. Thirty percent of the students had a rural Tennessee background, 54% an urban Tennessee background, and 15% were from outside Tennessee. Most of the respondents stated their religious preference as Protestant (Table 1).

The distribution of the students among years in college was fairly even for the males, but 65% of the females were freshmen or sophomores (Table 2). All colleges of The University of Tennessee, Knoxville, were represented in the final sample except the School of Architecture. Approximately 46% of the females in the study and 21% of the males were from the College of Home Economics (Table 2). Approximately 60% of the students, both male and female lived in dorms, fraternity houses, or apartments (Table 3). Appliances for storage and preparation of food were available to many college students (Table 3). Only a small percentage of the sample had gardens during 1980. This probably can be attributed to the high percentage of students living in apartments or dorms.

Table 1—Demographic characteristics of college student sample

Characteristic	% of sample
Gender[a]	
Female	81
Male	19
Age[b]	
<19 years	15
19-22 years	72
23-30 years	11
31-40 years	2
41-50 years	0
Race[a]	
Asian	1
Black	7
White	92
Religion[a]	
Catholic	12
Eastern Orthodox	0
Jewish	1
Protestant	77
Seventh-Day Adventist	1
Other	3
No preference	7
Area of Residence[c]	
Rural Tennessee	30
Urban Tennessee	54
Outside Tennessee	15

[a]Males n=58, females n=245.
[b]Males n=58, females n=244 due to omitted responses.
[c]Males n=57, females n=241 due to omitted responses.

Table 2—Educational characteristics of college student sample

Characteristics	% males	% females
Year in college[a]		
Freshmen	16	25
Sophomore	26	40
Junior	29	20
Senior	29	12
Other	0	2
College major[b]		
Agriculture	10	2
Architecture	0	0
Business	25	6
Communications	0	1
Education	12	16
Engineering	2	0
Home Economics	21	46
Liberal Arts	26	17
Nursing	2	10
Other	2	2

[a]Males n=58, females n=244 due to omitted responses.
[b]Males n=57, females n=243 due to omitted responses.

Table 3—Residence characteristics of college student sample

Characteristics	% males	% females
Type of residence[a]		
Dormitory, fraternity house	31	34
Mobile home	0	1
Multiple-family dwelling	34	25
Rented room	10	3
Single-family dwelling	24	36
Other	0	0
Appliances available[b]		
Blender	54	56
Hot plate/ stove	77	77
Hot pot/ coffee pot	68	84
Popcorn popper	50	69
Refrigerator	86	85
Toaster	62	55
Vending machines	30	39
Had garden this year[c]	16	27

[a]Males n=58, females n=244 due to omitted responses.
[b]Males n=56, females n=242 due to omitted responses.
[c]Males n=58, females n=240 due to omitted responses.

Over 80% of both male and female students perceived that they had adequate funds to spend on food while at college (Table 4). Over 90% believed their family's income to be average or above. A high percentage of the students had mothers and fathers with more than a high school education. Most students had cars on campus (Table 4); therefore, their food choices were not limited to those provided near campus.

Eating Occasion Characteristics

When asked to report the number of meals per week usually eaten away from home, the majority of both the males and females responded with two or more. The popularity of fast food restaurants was exhibited because 61% of the males and 45% of the females reported that they visited these more frequently than other types of restaurants (Table 5). Brown bag lunches were not very popular among the students. only 21% of the males and 24% of the females carried them. A pattern of three meals per day was reported by 54% of the males and 42% of the females. These percentages were almost reversed for two meals per day. The number of snacks usually eaten per day reported by males and females was similar. Most reported that they snacked once or twice daily (Table 5). Almost 40% of the male respondents and 32% of the female respondents stated they were on a meal plan at the time of the survey. A very small percentage of the sample considered themselves vegetarians, 2% of the males and 3% of the females.

Table 4—Financial and family characteristics of college student sample

Characteristics	% males	% females
Perceived adequacy of amount of money to spend for food[a]		
Very inadequate	7	2
Inadequate	9	5
Adequate	55	52
Very adequate	16	31
Plentiful	14	10
Perceived level of family income[b]		
Very low	2	3
Below average	3	6
Average	52	41
Above average	31	37
High	12	13
During high school the family food preparer was employed outside the home[c]	51	49
Educational level of father[d]		
Less than high school	10	9
High school graduate	19	22
Vocational school graduate	3	4
Some college, no degree	24	18
B.S. or B.A.	16	25
M.S. or M.A. or M.F.A.	16	13
Doctorate	12	8
Educational level of mother[b]		
Less than high school	7	8
High school graduate	26	28
Vocational school graduate	3	5
Some college, no degree	40	25
B.S. or B.A.	19	23
M.A. or M.A. or M.F.A.	5	8
Doctorate	0	2
Presently receiving financial aid[e]	45	30
Have car on campus[e]	79	61

[a]Males n=58, females n=240 due to omitted responses.
[b]Males n=58, females n=237 due to omitted responses.
[c]Males n=57, females n=240 due to omitted responses.
[d]Males n=58, females n=235 due to omitted responses.
[e]Males n=58, females n=245.

Table 5—Eating occasion characteristics of college student sample

Characteristics	% males	% females
Number of meals per week eaten away from home or dorm[a]		
None	2	4
One	14	14
Two or three	29	38
Four or five	36	35
Six or more	19	9
Type of eating establishment visited most frequently[b]		
Cafeteria	7	12
Fast food	61	45
Full service (high price)	2	5
Full service (moderate price)	19	34
Pizza parlor	10	4
Sometimes carry a brown bag lunch[c]	21	24
Number of meals eaten per day[d]		
One	2	6
Two	40	50
Three	54	42
Four	4	1
Number of snacks eaten per day[e]		
None	7	7
One	31	37
Two	36	36
Three	22	16
Four	3	2
Five or more	0	1
On meal plan during survey[c]	40	32

[a]Males n=58, females n=239 due to omitted responses.
[b]Males n=57, females n=244 due to omitted responses.
[c]Males n=58, females n=244 due to omitted responses.
[d]Males n=55, females n=229 due to omitted responses.
[e]Males n=58, females n=238 due to omitted responses.

Food Consumption Patterns

The percentages of male and female students who did not consume food or beverages during various time periods throughout the day are shown in Table 6. These results show variability among days, between genders, and among time periods. Significantly more male and female students did not consume food or beverage before 10:00 A.M. on Saturday than did not eat during the same time period on Thursday or Friday. The first food consumption on Saturday may be later than is usual on a week-day because of the tendency to sleep late. Thirty-five percent of the female students did not consume food or beverage after 8:00 P.M. on Friday while only 17% of the males did not, a significant difference ($p \leq 0.05$). Between 2:00 P.M. and 5:00 P.M. on all three days 40% or more of the males and over 30% of the females did not consume food or beverage, a significantly larger percentage than during the time periods: 10:00 A.M.-2:00 P.M. and 5:00 P.M.-8:00 P.M. The percentages of students not eating during a time period did not exceed 50%, indicating that food is consumed throughout the day and that during no time period is food consumption strictly avoided. Variability also is exhibited in the percentages of students who chose foods from specific food groups during these time periods.

Before 10:00 A.M. the five food groups of fluid milk, meat and eggs, bread, fruit and vegetable beverages, and cereal were chosen most frequently for consumption by both males and females (Table 7). All these groups contain "typical" breakfast foods. Stasch et al. (1970) also found that milk was a popular breakfast food. Two other

Table 6—Percentages of male[a] and female[b] students who did not report food consumption during various time periods of three days

Time periods	Day 1 (Thursday)		Day 2 (Friday)		Day 3 (Saturday)	
	% male	% female	% male	% female	% male	% female
Before 10:00 A.M.	24	25	19	25	41	45
10:00 A.M. to 2:00 P.M.	10	14	9	21	17	18
2:00 P.M. to 5:00 P.M.	46	39	43	35	40	33
5:00 P.M. to 8:00 P.M.	16	16	14	16	16	19
After 8:00 P.M.	31	42	17	35	38	37

[a] n=58.
[b] n=245.

Table 7—Mean[ab] percentages of males[c] and females[d] who chose at least one food from each food group during 5 time periods

Food group	Before 10:00 A.M.		10:00 A.M.--2:00 P.M.		2:00 P.M.--5:00 P.M.		5:00 P.M.--8:00 P.M.		After 8:00 P.M.	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Fluid milk	46x	34y	33x	19y	12x	10x	29x	19y	18x	6y
Milk products	6x	4x	32x	28x	10x	16x	17x	22x	14x	12x
Meat and eggs	35x	29x	60x	46y	18x	21x	68x	59y	21x	13y
Legumes	2x	1x	14x	7x	6x	4x	10x	8x	5x	2x
Bread	32x	30x	60x	49y	21x	22x	49x	39y	21x	12y
Cereal	16x	18x	4x	4x	2x	1x	3x	5x	3x	1x
Pasta	0x	0x	4x	2x	2x	2x	6x	8x	2x	1x
Desserts	8x	9x	13x	13x	8x	13x	12x	12x	14x	11x
Salty snacks	0x	0x	6x	6x	1x	3x	2x	2x	6x	8x
Cooked starchy vegetables	1x	1x	29x	16y	9x	7x	40x	31y	5x	7x
Cooked other vegetables	1x	0x	12x	12x	6x	8x	29x	30x	6x	4x
Raw vegetables	2x	1x	21x	15x	7x	9x	16x	21x	3x	5x
Fruit	12x	11x	20x	15x	11x	13x	11x	11x	9x	10x
Fruit and vegetable beverages	25x	29x	10x	9x	3x	5x	3x	6x	1x	5x
Tea and coffee	12x	15x	10x	14x	2x	9x	18x	15x	8x	9x
Carbonated beverages	3x	3x	29x	28x	21x	19x	18x	19x	17x	18x
Alcoholic beverages	1x	0x	2x	0x	3x	1x	8x	4x	19x	13x
Other beverages	5x	1x	5x	2x	2x	3x	3x	2x	4x	1x

[a]Mean of three days.
[b]Percentages for males and females within food group and time period followed by like letters do not differ ($p \geq 0.05$).
[c]n=58.
[d]n=245.

food groups that were popular before 10:00 A.M. were tea and coffee, and fruit with over 10% of the males and females consuming something from those groups. Fluid milk was chosen by 46% of the male sample, significantly ($p \leq 0.05$) more than the 34% of the female sample who consumed fluid milk.

Food group choices between 10:00 A.M. and 2:00 P.M. are shown in Table 7. This time period encompasses the lunch time of most individuals. The meat and eggs group and bread group were both chosen by 60% of the male college students. Carbonated beverages were consumed by 29% and 28% of the males and females, respectively, their highest frequency of consumption during any time period. A significantly ($p \leq 0.05$) higher percentage of the males consumed at least one serving of meat and eggs, bread, fluid milk, and cooked starchy vegetables than did the females (Table 7). This may indicate that during this time period males were more likely to eat these foods that are sometimes considered to be "fattening" foods.

During the 2:00 P.M. - 5:00 P.M. time period, no food group was chosen for consumption by more than 25% of the sample (Table 7). This could be due to the absence of "typical" meal times during this time period. The carbonated beverage group was chosen by approximately 20% of both males and females during this time period. No significant differences were found in percentages of males and females choosing food from a specific food group during this time period.

The meat and eggs group and bread group were the most popular choices during the time period from 5:00 P.M. to 8:00 P.M., as shown in Table 7. Cooked starchy vegetables were consumed by 40% of the

males and 31% of the females, and was the third most frequently consumed group by both genders. The percentages of males who chose to consume foods from the meat and eggs group, bread group, cooked starchy vegetables group, and fluid milk group were significantly ($p \leq 0.05$) higher than the percentages of females.

After 8:00 P.M. (Table 7) 19% of the males and 13% of the females consumed at least one serving of an alcoholic beverage, a significant difference at $p \leq 0.05$. The dessert group was chosen by 14% and 11% of the males and females, respectively. Carbonated beverages ranked number one among females with 18% choosing to consume at least one serving during this time period. Significantly ($p \leq 0.05$) larger percentages of males than females consumed foods from the meat and eggs, bread, and fluid milk groups.

None of the 18 food groups were completely avoided by the college student sample, but some groups were chosen more frequently than others. The meat and eggs group and bread group were popular among both males and females during all time periods. Fluid milk ranked consistently in the top five food groups chosen by male college students (Table 7). A significantly ($p \leq 0.05$) higher percentage of males chose to consume fluid milk during four time periods than did females. Carbonated beverages were chosen by over 18% of both males and females during the four time periods after 10:00 A.M. These two groups of beverages, fluid milk and carbonated beverages, were in the top five ranks more often than the other beverage groups. This supports the findings of Kahn (1980) that milk and cola beverages were chosen more often by college students than were other beverages.

Consumption of cereals and fruit and vegetable beverages dropped to levels below 10% after 10:00 A.M. This suggests that college students may identify these foods with early consumption or as breakfast foods. Percentages of males and females consuming cooked vegetables peaked between 5:00 P.M. and 8:00 P.M.

The numbers of servings consumed per day of the 18 food groups used in this study and servings of total added fat and total added sugars are shown in Table 8. Males consumed a significantly higher number of servings from the meat and eggs group than did females. These findings support those of Schuck (1969) who indicated that male college students were more willing to consume meat than were female college students. Males also consumed a significantly higher number of servings of legumes, cooked starchy vegetables, and bread than did females. A trend ($p \leq 0.09$) toward higher consumption of cereals by males than by females was found. Males consumed 2.1 servings of milk per day, significantly ($p \leq 0.05$) greater than the number of servings (1.0) consumed by females. Alcoholic beverages, other beverages, and total added sugars also were consumed in greater quantities by males than by females.

For further analysis of data, the 18 food groups, total added fat, and total added sugar were collapsed into 5 groups labeled: Dairy; Meat; Fruits and Vegetables; Grain; and Other. The Dairy, Meat, Fruit and Vegetable, and Grain groups were essentially the same as the Four Food Groups (Vail, 1978). The Other food group consisted of the dessert group, salty snack group, tea and coffee group, carbonated beverages group, other beverages group, added fat, and added

Table 8—Least squares means[a] of number of servings consumed daily by male and female college students[bc]

Food group	Males	Females
Milk products	1.2±0.1x	1.1±0.1x
Meat and eggs	3.6±0.1x	2.3±0.1y
Legumes	0.5±0.1x	0.2±0.0y[d]
Fruit	0.8±0.1x	0.7±0.1x
Cooked starchy vegetables	1.1±0.1x	0.8±0.1y
Cooked other vegetables	0.7±0.1x	0.7±0.1x
Raw vegetables	0.8±0.1x	1.0±0.1x
Bread	2.5±0.1x	1.6±0.1y
Cereal	0.4±0.1x	0.3±0.0x[d]
Pasta	0.2±0.0x[d]	0.1±0.0x[d]
Desserts	0.7±0.1x	0.7±0.1x
Salty snacks	0.2±0.0x[d]	0.2±0.0x[d]
Fluid milk	2.1±0.1x	1.0±0.1y
Fruit and vegetable beverages	0.6±0.1x	0.6±0.1x
Tea and coffee	0.5±0.1x	0.7±0.1x
Alcoholic beverages	1.2±0.2x	0.6±0.1y
Carbonated beverages	1.2±0.1x	1.0±0.1x
Other beverages	0.2±0.0x[d]	0.1±0.0y[d]
Total added fat	1.4±0.1x	1.1±0.1x
Total added sugar	0.6±0.1x	0.3±0.1y

[a]LSM±SE of values for 288 individuals taken from 3-day Food Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).
[d]S.E. <0.1.

sugars. The effects of gender, area of residence, subscription to a meal plan, year in college, and college major on servings consumed of these five food groups were investigated.

Consumption of the Dairy, Meat, Grain, and Other food groups by males and females was significantly ($p \leq 0.05$) different. Males consumed approximately one more serving from each of these groups than did females. Fruit and vegetable consumption by males and females was very similar, 4.0 and 3.8 servings, respectively (Table 9). The male and female students consumed 6.0 and 4.7 servings of foods from the Other group. Consumption of these foods may result in lower consumption of foods of higher nutrient density.

Students from urban Tennessee, rural Tennessee, and outside Tennessee consumed similar numbers of servings of the Dairy, Fruit and vegetable, and Other food groups (Table 10). Significant ($p \leq 0.05$) differences were found between the number of servings consumed from the Meat and Grain groups. Students from rural Tennessee backgrounds consumed significantly ($p \leq 0.05$) more servings from the Meat group than did the students from an urban Tennessee background. A trend ($p \leq 0.08$) toward the same results between students of rural Tennessee backgrounds and students from outside Tennessee was indicated. Students from rural Tennessee backgrounds also consumed a significantly higher number of servings from the Grain group than did both the other samples of students. Greater consumption of these groups supports findings of Brown (1967) who reported that college students from rural areas were perceived to have larger appetites than those college students from urban areas.

Table 9—Least squares means[a] of number of servings consumed daily from five composite food groups by male and female college students[bc]

Composite food group	Males	Females
Dairy[d]	3.3±0.2x	2.1±0.1y
Meat[e]	4.0±0.2x	2.5±0.1y
Fruit and vegetables[f]	4.1±0.3x	3.8±0.2x
Grain[g]	3.0±0.1x	2.1±0.1y
Other[h]	6.0±0.4x	4.7±0.2y

[a]LSM±SE of 3-day means for 288 individuals taken from 3-day Food Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).
[d]Sum of milk products group and fluid milk group.
[e]Sum of meat group and legume group.
[f]Sum of fruit group, cooked starchy vegetable group, cooked other vegetable group, raw vegetable group, and fruit and vegetable beverage group.
[g]Sum of bread group, cereal group, and pasta group.
[h]Sum of dessert group, salty snack group, tea and coffee group, carbonated beverage group, other beverages group, added fat, and added sugars.

Table 10—Least squares means of number of servings consumed daily from five composite food groups by college students from three areas of home residence

Composite food group	Rural Tennessee	Urban Tennessee	Outside Tennessee
Dairy[e]	2.7±0.1x	2.6±0.1x	2.7±0.2x
Meat[f]	3.5±0.1x	3.2±0.1y	3.1±0.2xy
Fruit and vegetable[g]	4.0±0.2x	3.8±0.2x	4.1±0.3x
Grain[h]	2.9±0.1x	2.5±0.1y	2.3±0.2y
Other[i]	5.5±0.3x	5.5±0.3x	5.0±0.5x

[a]LSM±SE of 3-day means for 288 individuals taken from 3-day Food Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).
[d]Sum of milk products group and fluid milk group.
[e]Sum of meat group and legume group.
[f]Sum of fruit group, cooked starchy vegetables group, cooked other vegetables group, raw vegetables group, and fruit and vegetable beverages group.
[g]Sum of bread group, pasta group, and cereal group.
[h]Sum of dessert group, salty snack group, tea and coffee group, carbonated beverage group, other beverage group, added fat, and added sugars.

Students who were not on a meal plan and those who were on a meal plan consumed a similar number of servings from the Dairy, Meat, and Other groups (Table 11). The meal plan subscribers consumed a significantly lower number of servings of Grain products than did those students who were not on a meal plan. The difference in consumption from the Fruit and vegetable group approached significance ($p \leq 0.10$). Findings by Gottschalk et al. (1977) showed significant differences in fruit and vegetable consumption and milk consumption of students on a meal contract compared to those students not on a meal contract.

The effects of year in college on the number of servings consumed from each food group are shown in Table 12. The only significant difference found was between Grain group consumption by freshmen and that by sophomores and juniors. Freshmen consumed a higher ($p \leq 0.05$) number of servings than did the sophomore and junior students. The numbers of servings consumed by home economics majors and non-home economics majors are shown in Table 13. No significant differences were found. A trend was found ($p \leq 0.07$) toward higher consumption of foods from the Meat group by non-home economics majors than by home economics majors.

Even though food consumption patterns of this college student sample exhibited variability, some results did suggest patterns that may be "typical" of college students. Of the five independent variables studied, gender and area of home residence exhibited more significant influences on the consumption of food groups by college students than did the other independent variables.

Table 11—Least squares means[a] of number of servings consumed daily from five composite food groups by meal plan participants and non-participants[bc]

Composite food groups	Participants	Non-participants
Dairy[d]	2.8±0.1x	2.6±0.1x
Meat[e]	3.3±0.1x	3.3±0.1x
Fruit and vegetable[f]	4.2±0.2x	3.8±0.2x
Grain[g]	2.4±0.1x	2.7±0.1y
Other[h]	5.3±0.3x	5.4±0.3x

[a]LSM±SE of 3-day means for 288 individuals taken from 3-day Food Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).
[d]Sum of milk products group and fluid milk group.
[e]Sum of meat group and legume group.
[f]Sum of fruit group, cooked starchy vegetable group, cooked other vegetable group, raw vegetable group, and fruit and vegetable beverage group.
[g]Sum of bread group, cereal group, and pasta group.
[h]Sum of dessert group, salty snack group, tea and coffee group, carbonated beverage group, other beverage group, added fat, and added sugars.

Table 12—Least squares means[a] of number of servings consumed daily from five composite food groups by freshmen, sophomore, junior, and senior college students[bc]

Composite food group	Freshmen	Sophomores	Juniors	Seniors
Dairy[d]	2.7±0.2x	2.6±0.1x	2.7±0.2x	2.6±0.2x
Meat[e]	3.2±0.2x	3.1±0.1x	3.3±0.1x	3.4±0.2x
Fruit and vegetable[f]	3.7±0.3x	4.2±0.2x	4.0±0.2x	4.0±0.3x
Grain[g]	2.8±0.1x	2.4±0.1y	2.4±0.1y	2.6±0.2xy
Other[h]	5.3±0.4x	5.2±0.3x	5.2±0.4x	5.6±0.5x

[a]LSM±SE of 3-day means for 288 individuals taken from 3-day Food Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).
[d]Sum of milk products group and fluid milk group.
[e]Sum of meat group and legume group.
[f]Sum of fruit group, cooked starchy vegetable group, cooked other vegetable group, raw vegetable group, and fruit and vegetable beverage group.
[g]Sum of bread group, cereal group, and pasta group.
[h]Sum of dessert group, salty snack group, tea and coffee group, carbonated beverage group, other beverage group, added fat, and added sugars.

Table 13—Least squares means[a] of number of servings consumed daily from five composite food groups by home economics and non-home economics majors[bc]

Composite food group	Home economics	Non-home economics
Dairy[d]	2.7±0.1x	2.7±0.1x
Meat[e]	3.1±0.1x	3.4±0.1x
Fruit and vegetable[f]	3.9±0.2x	4.0±0.2x
Grain[g]	2.6±0.1x	2.6±0.1x
Other[h]	5.1±0.3x	5.6±0.3x

[a]LSM±SE of 3-day means for 288 individuals taken from 3-day Food Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).
[d]Sum of milk products group and fluid milk group.
[e]Sum of meat group and legume group.
[f]Sum of fruit group, cooked starchy vegetables group, cooked other vegetables group, raw vegetables group, and fruit and vegetable beverages group.
[g]Sum of bread group, cereal group, and pasta group.
[h]Sum of dessert group, salty snack group, tea and coffee group, carbonated beverage group, other beverage group, added fat, and added sugars.

Nutrient Intakes

Percentages of the RDA consumed by males and females for eight nutrients and energy are shown in Figure 1. Both male and female kilocalorie intakes were below 100% of the RDA. Male college students' kilocalorie (kcal) intakes averaged 2860 kcals, while females' intakes were 1669 kcals (Table 14, Figure 1). These values suggest that kilocalorie intake of many female college students may be low, whereas kilocalorie intakes of males seems to be adequate. The distributions of kilocalories provided by the energy nutrients were similar for males and females, 16-17% from protein, 36% from fat, 43-45% from carbohydrate, and 3-4% from alcohol. These data are similar to those reported by Gottschalk et al. (1977). No significant differences ($p \leq 0.05$) in calorie distributions were found between males and females. The percentage of kilocalories provided by fat in the college students' diets, 36%, is similar to the recommended level of 35% (FNB, 1980).

Protein consumption by males was 123 grams (Table 14), well above the RDA for protein for males (Figure 1). Female college students had a protein intake of 66 grams, also above the RDA for these female students (Figure 1). Both the intakes in grams and percentages of the RDA were significantly higher ($p \leq 0.05$) for males than for females. These results support previous reports of protein consumption above the RDA by college students (Driskell et al., 1979; Gottschalk et al., 1977; Jakobovits et al., 1977; Wise and Fuqua, 1974). High protein intakes for college students in this sample were not surprising because number of servings from the Meat group consumed by males and females were 4.0 and 2.5, respectively (Table 9).

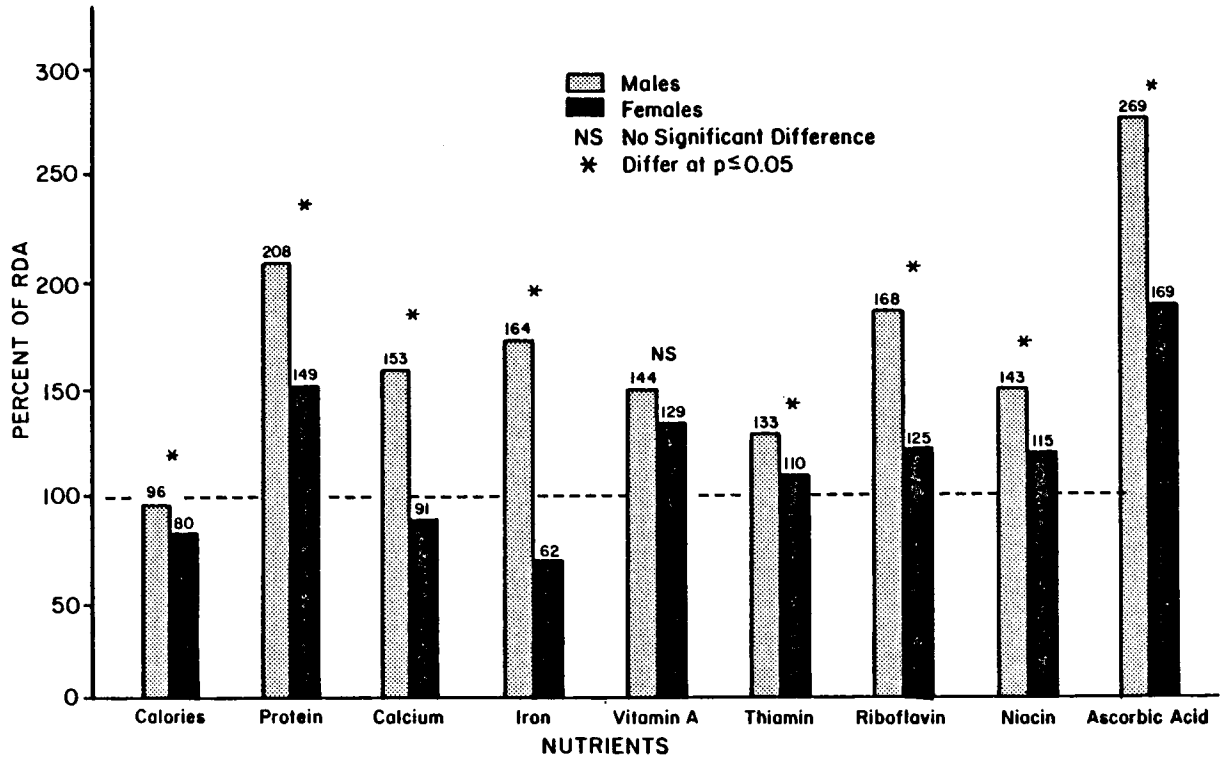

Fig. 1—Comparison of percent of RDA's consumed by males and females.

Table 14—Least squares means[a] of energy and nutrient intakes of male and female college students[bc]

Nutrient	Male	Female
Energy (kcal)	2860±89x	1669±50y
Protein (g)	123±5x	66±3y
Fat (g)	120±5x	67±3y
Carbohydrate (g)	301±10x	189±6y
Calcium (mg)	1291±64x	724±36y
Iron (mg)	17.1±0.7x	11.1±0.4y
Vitamin A (I.U.)	7650±700x	4875±397y
Thiamin (mg)	1.92±0.08x	1.19±0.04y
Riboflavin (mg)	2.80±0.12x	1.63±0.07y
Niacin (mg)	26.2±1.2x	16.8±0.7y
Ascorbic acid (mg)	172±12x	99±7y

[a]LSM±SE of 3-day means for 288 individuals taken from Summary Nutrient Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).

Fat intake by male college students was almost twice ($p \leq 0.05$) that of females at 120 g and 67 g, respectively. Carbohydrate intakes were 301 g for males and 189 g for females, a significant difference ($p \leq 0.05$) (Table 14) and provided almost 1/2 of the total kilocalorie intake of the college students in this sample. Similar contributions by carbohydrate to kilocalorie intake of college students were reported by Gottschalk et al. (1977).

The RDA for calcium for adult males and females are 800 mg (FNB, 1980). The male college students in this sample consumed 1291 mg, well above recommended allowances. The female population of this sample had a mean calcium intake below the RDA (Figure 1, Table 14). White (1968) also reported an average calcium intake by females below the RDA. As reported earlier in Table 7, a smaller percentage of females chose to consume fluid milk than did males during 4 time periods. Approximately 30% of these female students had calcium intakes below 2/3's of the RDA.

The least squares mean iron intake of male college students participating in this study was above the RDA. Researchers in other studies also have reported adequate iron intakes by male college students (Driskell et al., 1979; Gottschalk et al., 1977; Ostrom and Labuza, 1977). Females consumed significantly less ($p \leq 0.05$) iron than did males (Table 14). A large difference becomes apparent when the added factor of the 18 mg RDA for females compared to the 10 mg RDA for males is used to calculate the percentage RDA consumed. As shown in Figure 1, females consumed only 62% of the RDA for iron. Over 50% of the female college students in this sample had iron

intakes below 2/3's of their RDA. Many other researchers have reported low intakes of iron among female college students (Driskell et al., 1979; Gottschalk et al., 1977; Jakobovits et al., 1977; Ostrom and Labuza, 1977; White, 1968). The results of this study reinforce the evidence that iron intakes of young women of college age should be of great concern.

Intakes of vitamin A of male and female students were well above the RDA at 7650 I.U. and 4875 I.U., respectively. These values are greater than values reported for 19-20 year old males and females in the Nationwide Food Consumption Survey 1977-1978 (NFCS) (USDA, 1980). The intakes reported in the NFCS were 5,105 I.U. for males and 3,796 I.U. for females. As shown in Figure 1, the high intakes in the present study translate into percentages above 100% of the RDA for males and for females. Jakobovits (1977) reported a mean intake of 171% of the RDA for females. The large intakes in the present study were due partially to a small percentage of the students who had extremely high intakes of over 25,000 I.U. of vitamin A per day. These high intakes were a result of consumption of large amounts of calves' liver, dark yellow, and dark green vegetables. The large amounts of milk consumed by males also contributed to the high levels of vitamin A consumed. Ostrom and Labuza (1977) also reported skewed vitamin A intakes among college students.

Thiamin, riboflavin, and niacin intakes of males and females in this study were all above the recommended levels (Figure 1). Even so, males consumed significantly more ($p \leq 0.05$) of these nutrients than did

females (Table 14) and significantly higher ($p \leq 0.05$) percentages of the RDA than did females (Figure 1).

Mean ascorbic acid intakes of male and female college students in this sample were well above the RDA. The percentage of the RDA consumed by males was 269% and 169% by females (Figure 1). Males again consumed significantly more ($p \leq 0.05$) of this nutrient than did females (Table 14).

The effects of area of residence on nutrient intakes were investigated. The results are shown in Table 15. Fewer ($p \leq 0.05$) grams of carbohydrate were consumed by students from outside Tennessee than by those students from both rural and urban Tennessee. The distribution of kilocalories provided by protein, fat, carbohydrate, and alcohol indicated that a higher percentage of kilocalories consumed by college students from an urban Tennessee background were provided by alcohol than for those from a rural Tennessee background.

Nutrient intakes of students on meal plans and those not on meal plans are shown in Table 16. No significant differences ($p \leq 0.05$) between these two groups were found for energy and nutrient consumption.

Nutrient intakes for college freshmen, sophomores, juniors, and seniors are shown in Table 17. The sophomores consumed less ($p \leq 0.05$) niacin than did the senior students.

Table 18 shows that home economics majors in this sample consumed significantly higher ($p \leq 0.05$) amounts of niacin than did non-home economics majors. While these figures are significant, the high

Table 15—Least squares means[a] of energy and nutrient intakes of college students from three areas of home residence[bc]

Nutrient	Rural Tennessee	Urban Tennessee	Outside Tennessee
Energy (kcal)	2390±72x	2249±66x	2155±100x
Protein (g)	100±4x	91±4x	93±6x
Fat (g)	101±4x	91±4x	90±6x
Carbohydrate (g)	261±8x	249±7x	224±12y
Calcium (mg)	1058±52x	992±46x	971±72x
Iron (mg)	15.0±0.6x	13.5±0.5x	13.9±0.8x
Vitamin A (I.U.)	7171±570x	5781±50x	5836±786x
Thiamin (mg)	1.57±0.07x	1.50±0.06x	1.61±0.09x
Riboflavin (mg)	2.35±0.10x	2.11±0.09y	2.17±0.13x
Niacin (mg)	21.5±0.9x	20.6±0.8x	22.5±1.3x
Ascorbic acid (mg)	134±10x	127±9x	146±14x

[a]LSM±SE of 3-day means for 288 individuals taken from Summary Nutrient Record Forms.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).

Table 16—Least squares means[a] of energy and nutrient intakes of meal plan participants and non-participants[bc]

Nutrients	Participants	Non-Participants
Energy (kcal)	2315±71x	2214±62x
Protein (g)	93±4x	97±4x
Fat (g)	93±4x	94±4x
Carbohydrate (g)	254±8x	235±7x
Calcium (mg)	1005±51x	1010±45x
Iron (mg)	13.8±0.6x	14.4±0.5x
Vitamin A (I.U.)	6087±557x	6439±491x
Thiamin (mg)	1.52±0.07x	1.60±0.06x
Riboflavin (mg)	2.28±0.10x	2.24±0.09x
Niacin (mg)	21.8±0.9x	21.3±0.8x
Ascorbic acid (mg)	133±10x	139±9x

[a]LSM±SE of 3-day means for 288 individuals taken from Summary Nutrient Record Form.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).

Table 17—Least squares means[a] of energy and nutrient intakes of freshman, sophomore, junior, and senior college students[bc]

Nutrient	Freshmen	Sophomores	Juniors	Seniors
Energy (kcal)	2315±88x	2210±73x	2270±82x	2264±101x
Protein (g)	94±5x	90±4x	102±5x	93±6x
Fat (g)	94±5x	89±4x	97±5x	94±6x
Carbohydrate (g)	255±10x	246±9x	234±10x	246±12x
Calcium (mg)	1028±64x	1018±53x	1024±60x	960±74x
Iron (mg)	14.4±0.7x	13.4±0.6x	14.1±0.7x	14.7±0.9x
Vitamin A (I.U.)	5756±698x	5964±575x	6546±648x	6785±800x
Thiamin (mg)	1.53±0.08x	1.47±0.07x	1.52±0.08x	1.71±0.10x
Riboflavin (mg)	2.24±0.12x	2.13±0.10x	2.23±0.11x	2.25±0.14x
Niacin (mg)	21.1±1.2xy	19.6±1.0x	21.9±1.1xy	23.6±1.3y
Ascorbic acid (mg)	132±12x	141±10x	142±12x	127±14x

[a]LSM±SE of 3-day means of 288 individuals taken from Summary Nutrient Record Form.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).

Table 18—Least squares means[a] of energy and nutrient intakes of home economics majors and non-home economics majors[bc]

Nutrient	Home economics	Non-home economics
Energy (kcal)	2319±72x	2210±58x
Protein (g)	97±4x	93±3x
Fat (g)	95±4x	92±3x
Carbohydrate (g)	248±8x	242±7x
Calcium (mg)	1026±52x	988±42x
Iron (mg)	14.2±0.6x	14.1±0.5x
Vitamin A (I.U.)	6245±568x	6281±455x
Thiamin (mg)	1.56±0.07x	1.56±0.05x
Riboflavin (mg)	2.22±0.10x	2.20±0.08x
Niacin (mg)	22.6±0.9x	20.5±0.8y
Ascorbic acid (mg)	139±10x	132±8x

[a]LSM±SE of 3-day means for 288 individuals taken from Summary Nutrient Record Form.
[b]Tested by least squares analysis of variance with the following independent variables: gender, area of home residence, subscription to meal plan, year in college, and college major.
[c]Means in the same row followed by like letters do not differ ($p \geq 0.05$).

levels of protein consumed and the adequacy of niacin intake itself by all groups may offset the importance of these differences.

Dietary, Knowledge, and Attitude Scores

Least squares mean dietary scores were calculated for subsets of the college student sample and are shown in Table 19. The least squares mean for males was 17.1 of a possible 18. The female students' least squares mean score was 15.0, which was significantly less ($p \leq 0.05$) than the male college students' score. This is another indication that diets of male college students are more adequate than were those of females. The least squares means for the dietary scores of students from rural and urban backgrounds also are shown. The least squares mean scores of 16.2 by rural students and 15.8 for urban students were not significantly different. Likewise, no significant differences were found among the dietary scores of freshman, sophomore, junior, or senior college students; students on a meal plan versus those not on a meal plan; or home economics majors versus non-home economics majors. Therefore, gender was the only independent variable studied that influenced the dietary score of an individual.

The least squares mean scores of the 40 question nutrition knowledge pretest for sample subsets are shown in Table 19. The male college students scored 15.7 or 39% and the females scored 16.1 or 40%. No significant difference between the scores of the two genders was found. Males and females also received similar scores on nutrition knowledge tests administered by Toma (1974) and by McCarthy (1973). Students from urban and rural backgrounds did not have significantly

Table 19—Least squares means of dietary[a], knowledge[b], and attitude[b] scores of college student sample

Independent variables	Scores[cd]		
	Dietary[e]	Knowledge[f]	Attitude[g]
Gender			
Male	17.1±0.4x	15.7±0.6x	102.3±1.7x
Female	15.0±0.2y	16.1±0.3x	104.5±1.0x
Area of residence			
Rural Tennessee	16.2±0.3x	16.2±0.5x	101.4±1.4x
Urban Tennessee	15.8±0.3x	15.9±0.4x	103.5±1.2x
Outside Tennessee	16.0±0.4x	15.6±0.6x	105.4±1.9x
Meal plan participation			
Yes	15.9±0.3x	16.2±0.5x	103.0±1.4x
No	16.2±0.3x	15.6±0.4x	103.8±1.2x
Year in college			
Freshman	15.6±0.4x	14.4±0.6x	99.9±1.7x
Sophomore	16.0±0.3x	15.2±0.5x	102.9±1.4xy
Junior	16.3±0.4x	15.8±0.5x	104.0±1.6xy
Senior	16.2±0.4x	18.1±0.7y	106.8±1.9y
College major			
Home economics	16.2±0.3x	15.6±0.5x	104.7±1.4x
Non-home economics	15.9±0.2x	16.2±0.4x	102.0±1.1x

[a]LSM±SE of scores of 288 individuals derived from 3-day mean energy and nutrient intakes.
[b]LSM±SE of scores for 288 individuals.
[c]Means in the same column within independent variables followed by like letters do not differ ($p \geq 0.05$).
[d]Tested by least squares analysis of variance with the following variables: gender, area of home residence, subscription to meal plan, year in college, college major.
[e]Maximum score of 18.
[f]Maximum score of 40.
[g]Maximum score of 145.

different nutrition knowledge pretest scores. Subscription to a meal plan or college major had no significant effect on least squares mean nutrition knowledge scores of college students who took part in this study. Senior college students were found to make higher scores on the nutrition knowledge pretest than the freshman, sophomore, and junior students.

Least squares mean attitude pretest scores for male college students and female college students were not significantly different from each other (Table 19). Students from rural and urban backgrounds scored similarly with no significant differences being found. Also in Table 19, pretest nutrition attitude scores are shown to increase as years in college increase. Senior students' least squares mean scores are significantly ($p \leq 0.05$) different from the freshmen's scores. No differences were found among least squares mean attitude scores for those students on a meal plan and those not on a meal plan. The difference in least squares mean attitude scores of home economics majors and non-home economics majors approached significance ($p \leq 0.07$). This indicates a more positive attitude toward nutrition may be held by home economics majors than by students from other majors.

Spearman's rank correlation results show a positive ($p \leq 0.05$) relationship between knowledge scores and attitude scores of both males and females. Correlation coefficients were 0.50 and 0.39, respectively. Werblow et al. (1971) also found nutrition knowledge and attitudes to be positively correlated. When nutrition knowledge and attitude scores were correlated with dietary scores, no significant relationship was found. No correlation between nutrition knowledge and dietary

practices was found in past research (Alexander, 1978; Schwartz, 1975; Wise and Fuqua, 1974). The lack of relationship between nutrition knowledge and dietary practices suggests that nutrition educators need to strive for more than an increase in knowledge in order to change undesirable dietary practices.

CHAPTER V

SUMMARY AND CONCLUSIONS

Food consumption patterns, nutrient intakes, and food and nutrition knowledge and attitudes of college students who enrolled in Nutrition 1230 at The University of Tennessee, Knoxville during 1980 were investigated. Students participating in this study completed a consent form and a demographic data form, in addition to the required course assignments of a three-day food record, nutrient calculations of the food they consumed, and a knowledge and attitude pretest and posttest. For statistical analyses of food consumption patterns, nutrient intakes, and food and nutrition knowledge and attitudes, the following five independent variables were used: gender, area of home residence, subscription to a meal plan, year in college, and college major.

The college student sample was predominantly female. Thirty percent of the students had a rural Tennessee background, 54% an urban Tennessee background, and 15% were from outside Tennessee. Over 1/3 of the students were on a meal plan during the survey. Fifty-eight percent of the males were classified as juniors or seniors, while 65% of the females were freshmen or sophomores. In addition, a larger percentage of the females (46%) were home economics majors than were the males (21%).

The patterns of three meals per day and two meals per day were both popular among these college students. The number of snacks usually eaten per day reported by males and females was similar.

Food consumption patterns were summarized from data on consumption or non-consumption of foods from 18 food groups during 5 time periods and from the average number of servings consumed from each food group for the total day. Percentages of students who did not eat during various time periods of three days varied among time periods, but during no time period did more than 50% of the students not eat. Percentages of males and females who chose not to eat during each time period generally were similar. When the same time periods among days were compared, the only difference found was that fewer students ate before 10:00 A.M. on Saturday than before 10:00 A.M. on Thursday or Friday. None of the 18 food categories was completely avoided by the college student sample, but some groups were more popular than others. The meat and eggs group and bread group were consistently in the top five food groups chosen by both genders, as was the fluid milk group for males only. Carbonated beverages were popular choices among both males and females after 10:00 A.M. Consumption from the cereals group and fruit and vegetable beverages group was highest before 10:00 A.M. Dessert and fruit consumption was consistent throughout the day. Although the percentages of males and females choosing to consume foods from a food group during a time period were generally similar, a few differences were found. A higher percentage of males than females consumed at least one serving from the fluid milk group in the time period before 10:00 A.M.; the meat and eggs group, bread group, fluid milk group, and cooked starchy vegetable group in the time periods 10:00 A.M.-2:00 P.M. and 5:00 P.M.-8:00 P.M.; and the alcoholic beverage group, meat and eggs group, bread

group, and fluid milk group after 8:00 P.M. When numbers of servings consumed for the total day from the 18 food groups were investigated, males consumed more servings from the following groups than did females: meat and eggs, legumes, cooked starchy vegetables, breads, fluid milk, alcoholic beverages, other beverages, and total added sugars.

For further analysis, the 18 food groups were collapsed into 5 food groups, similar to the USDA's Five Food Groups. Although there were many similarities in the numbers of servings consumed, the variables area of home residence, subscription to meal plan, and year in college were related to the numbers of servings consumed from at least one of the five composite food groups. Rural Tennessee students consumed more servings from the Meat group than did students from urban Tennessee backgrounds. Grain group consumption was related to area of home residence, meal plan participation, and year in college.

Although energy consumption of both genders was below the RDA, mean nutrient intakes of male and female college students were generally above the RDA. However, mean intakes of females were below the RDA for iron and calcium. Gender was shown to greatly influence energy and nutrient intakes and dietary scores of college students. Males consistently consumed larger amounts and higher percentages of the RDA for energy and nutrients and also had a higher dietary score than did females. Only the percentages of the RDA for vitamin A were not significantly different between genders. Few differences in energy and nutrient intakes were found for the following independent variables: subscription to meal plan, area of home residence, year in

college, and college major. Carbohydrate and riboflavin intakes were influenced by area of home residence, and niacin intakes were influenced by year in college and college major.

Mean nutrition knowledge scores were low, less than 50% correct for all subgroups. A positive relationship ($p \leq 0.05$) was found between food and nutrition knowledge and attitude scores, but not between knowledge or attitude scores and dietary scores. Year in college was related to food and nutrition knowledge scores; seniors scored higher than did freshmen, sophomores, and juniors. The seniors' mean food and nutrition attitude score was significantly different from the score of the freshmen.

Results of this study indicate that food consumption patterns of college students are variable. Percentages of students choosing not to eat during various time periods differed. No food groups were totally avoided by this college student sample. Also, specific food groups were more popular during certain time periods than during other time periods. Differences were found in percentages of male and female students choosing to consume foods from food groups and numbers of servings consumed from these food groups.

The results of this study suggest that the diets of the college students sampled were more adequate than those diets of college students reported in previous research. Problem areas in this sample were females' intakes of kilocalories, iron, and calcium. All subgroups of the sample answered less than 50% of the nutrition knowledge questions correctly, indicating a general lack of nutrition knowledge.

A positive relationship between knowledge and attitude scores was shown, suggesting that increased knowledge may result in more positive attitudes toward nutrition.

Limitations of the Study

This sample was drawn from college students taking an introductory nutrition course at The University of Tennessee, Knoxville. Therefore, results of this study are applicable to other college student samples of similar socio-economic composition. The fact that this sample was taken from those students enrolled in a nutrition course may indicate that these students may have had a special interest in nutrition that could bias results. In addition, the use of a food record may influence food choices. Students may not have given a complete account or an accurate account of foods eaten. Because foods consumed by the students were recorded by time period, this study gives no evidence of meal patterns, number of eating occasions or snacks within each time period.

Implications of the Study

The college student has a great deal of responsibility for what, where, when, and how much he/she eats. Therefore, data about their food consumption patterns, nutrient intakes, and nutrition knowledge and attitudes are very useful in setting up college food service operations, improving food and nutrition education programs, and for use in identifying areas where further food and nutrition research is needed. Awareness of what foods are chosen by college students during

various time periods throughout the day will help food services provide adequate meals that the students accept and enjoy. This can decrease plate waste and increase efficiency in use of time and money by the facility. The variability exhibited in food consumption patterns of these college students indicates the need for careful planning of purchases and menus by the college food service operator.

The nutrient intakes of this college student sample suggest a greater adequacy of diets than among younger students. The problem areas of females' calcium and iron intakes need to be addressed by nutrition researchers, educators, and food providers. The adequacy of the diets of college students are not indicative of the adequacy of the diets of young adults in general. Therefore, research into food consumption patterns and nutrient intakes of other educational and socio-economic levels of young adults is needed. This would provide a frame of reference for this college student data, and thus make it more valuable.

The college setting may be the last chance for reaching many individuals through formal nutrition education. Results of this study show a low level of nutrition knowledge. Recognition of the food consumption patterns, nutrient intakes, and nutrition knowledge and attitudes of college students and the socio-demographic factors that may affect them is important. This recognition would help nutrition educators provide relevant instruction to different groups of individuals. There is evidence presented in this study that nutrition knowledge and attitudes and dietary practices are not related.

This suggests that although nutrition education programs may be successful in increasing knowledge about food and nutrition, the hoped change in dietary practices is not realized. Therefore, research into attitudes and other factors that may affect dietary practices would be important contributions toward reaching and perhaps solving some dietary problems exhibited by groups of individuals.

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APPENDICES

APPENDIX 1

ATTACHMENT E

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and Food Systems Administration
College of Home Economics
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University of Tennessee, Knoxville

Consent Form for Participation
in Project of

"Factors Affecting Food Habits of Young Adults"

I, _____, the undersigned agree to participate in the research project on "Factors Affecting the Food Habits of Young Adults." I voluntarily agree to have data derived from projects submitted by me in Nutrition _____, _____ quarter, 19___, and to complete the other activities required for the study.

I understand that I may withdraw my consent at any time and that participation or lack of participation in the project will not influence my grade in any way.

I have been informed to my satisfaction as to the nature of the projects in which I will participate and understand that I have the right to ask questions regarding each activity prior to my participation.

I further understand that my identity as a participant in this project will not be revealed in any way when the data from this project are published.

Signed _____

Date _____

APPENDIX 2

DEMOGRAPHIC DATA FOR COLLEGE STUDENTS

Circle the letter corresponding to the correct response:

1. Sex:
   a. Male
   b. Female

2. Age:
   a. less than 19 years
   b. 19-22 years
   c. 23-30 years
   d. 31-40 years
   e. 41-50 years
   f. over 51 years

3. Race:
   a. White
   b. Black
   c. Asian
   d. American Indian
   e. Hispanic
   f. Other, please specify_____

4. Religious Preference:

   a. Jewish
   b. Morman
   c. Seventh-Day Adventist
   d. Protestant
   e. Catholic
   f. eastern Orthodox
   g. Other, please specify_____
   h. No preference

5. Type of Residence:

   a. Single-family dwelling (house)
   b. Multiple-family dwelling (duplex, townhouse, apartment)
   c. Mobile home
   d. Dormitory, fraternity
   e. Rented Room
   f. Other, please specify_____

6. Number of people, other than yourself, living in the residence checked in question 5.

   a. none
   b. one
   c. two
   d. three
   e. four or more, please specify_____

7. Number of children living with you in the dwelling stated in question 5.

   a. none
   b. one
   c. two
   d. three
   e. four or more, please specify_____

8. How much choice do you have in selecting your food?

   a. No choices, all my food is served to me.
   b. No choices for meals, but some choices for snacks.
   c. Limited choices for meals, many choices for snacks.
   d. Complete choice for some meals, limited choice for other meals, many choices for snacks
   e. Complete choice of all food eaten.

9. Circle all of the following food supplements you receive in your present dwelling.

   a. WIC
   b. Food Stamps
   c. Other, please specify_____
   d. No Supplements

10. Do you or did you have a garden this year?

    a. yes
    b. no
    c. not this year, but have had a garden in the past years

11. On the average, how many meals per week do you eat away from home (or away from campus cafeteria if on a U.T. meal card)?

    a. none
    b. one meal
    c. two or three meals
    d. four or five meals
    e. six or more meals, please specify_____

12. Where do you obtain most of your meals? Please mark the place where you get most of your meals 1, then use 2 for the next most frequent source. Go on and use 3 and 4 if they apply to your situation.

_____campus cafeterias	_____snack shops/fast food restaurants
_____home	_____sit-down restaurants
_____homes of friends and relatives	_____other (specify)_____

13. If most of your food is prepared at home, where do you or the person responsible for preparation of your food get your food? Mark the place where you get most of your food 1, then use 2, 3, and 4 in order for the places where you buy less of your foods.

_____convenience market	_____farmer's market	_____supermarket
_____delicatessen	_____garden	_____other (specify): _____
_____food co-op	_____health food store	_____

14. When eating away from home - which type of eating establishment do you go most often?

    a. Fast food - Hamburger/Fish
    b. Pizza Parlor
    c. Cafeteria
    d. Full Service Restaurant - Moderate price, i.e. $3-5/person
    e. Full Service Restaruant - high price, i.e. $5/person or more

15. What is the main reason you go out to eat at the establishment checked in question 14?

    a. want a change of foods you are eating regularly
    b. have no cooking appliances in dwelling
    c. you hate to shop for groceries
    d. eating out is less expensive
    e. you hate to cook
    f. for convenience, you eat lunch away from home
    g. you don't have time to cook
    h. other, please specify_____

16. Are you presently on a meal plan at college?

    a. yes
    b. no

17. Do you ever carry a brown bag lunch from home to school or work?

    a. yes
    b. no (omit question 18 and go on to question 19)

18. How many times per week do you carry a brown bag lunch?

    a. less than 1 day per week
    b. 1 day per week
    c. 2 days per week
    d. 3 days per week
    e. 4 or 5 days per week
    f. 6 or 7 days per week

19. On the average, how many meals per day do you eat?

    a. none-snack only
    b. one
    c. two
    d. three
    e. four
    f. five or more, please specify_____

20. On the average, how many snacks per day do you eat?

    a. none
    b. one
    c. two
    d. three
    e. four
    f. five or more, please specify_____

21. Compared with other college students, how adequate do you consider the amount of money you have available to spend on food?

    a. Very inadequate-Often go without food due to lack of money
    b. Inadequate - Am able to choose foods only on basis of need
    c. Adequate - Have some ability to choose foods on basis of want & need
    d. Very adequate - May choose foods mainly on basis of want
    e. Plentiful - Money is no consideration in food choices

22. How do you consider your family's income?

    a. Very Low
    b. Below average
    c. Average
    d. Above average
    e. High

23. When you were in high school, did the person responsible for your food preparation work full-time outside the home?

    a. yes
    b. no

24. What is the educational level of your father?

    a. Less than high school
    b. High school graduate
    c. Some college, but no degree
    d. Bachelor of Science; Bachelor of Arts
    e. Master of Science, Master of Arts, Master of Fine Arts
    f. Doctorate (M.D., Ph.D., Ed.D., D.D.S., J.D.)
    g. Vocational school graduate

25. What is the educational level of your mother?

    a. Less than high school
    b. High school graduate
    c. Some college, but no degree
    d. Bachelor of Science; Bachelor of Arts
    e. Master of Science, Master of Arts, Master of Fine ARts
    f. Doctorate (MD., Ph.D., Ed.D., D.D.S., J.D., LLB)
    g. Vocational school graduate

26. Are you presently receiving any financial aid to attend school, other than from your parents?

    a. yes
    b. no

27. Do you have a car or truck with you on campus?

    a. yes
    b. no

28. What year are you in college?

    a. freshman
    b. sophomore
    c. junior
    d. senior
    e. graduate student

29. What is your college major?

    a. Business
    b. Education
    c. Liberal Arts
    d. Engineering
    e. Home Economics
    f. Agriculture
    g. Architecture
    h. Nursing
    i. Communication
    j. Other, please specify _____

30. Do you keep food/beverages in your room?

    a. yes
    b. no

31. Do you prepare food/beverages in your room or dorm?

    a. yes
    b. no

32. Check all of the following appliances/machines that are available to you in your home or dorm.

    _____Hot Pot/Coffee Pot
    _____Toaster
    _____Refrigerator
    _____Vending Machines
    _____Popcorn Popper
    _____Hot plate/stove
    _____Blender

33. What area of Tennessee is your home?

    a. East Tennessee - urban area
    b. East Tennessee - rural area
    c. Middle Tennessee - rural area
    d. Middle Tennessee - urban area
    e. West Tennessee - urban area
    f. West Tennessee - rural area
    g. Not from Tennessee

34. For Day 1 (January 10), in each of the time of day divisions below: State in Column A - how many people other than yourself were with you when each of the meals or snacks were eaten; and in Column B - who prepared the meal or snack eaten.

TIME OF DAY DIVISIONS	COLUMN A How many people ate with you?	COLUMN B Who prepared the meal or snack?
Food eaten before 10 a.m.		
Food eaten from 10 a.m. to 2 p.m.		
Food eaten from 2 p.m. to 5 p.m.		
Food eaten from 5 p.m. to 8 p.m.		
Food eaten after 8 p.m.		

APPENDIX 3

FOOD RECORD FORM

DATE_____

Height_____(inches) Weight_____(pounds)

Sex_____(male)
_____(female)

Age_____

	Food and Description	Amount	Other Information
Food eaten before 10 AM			
Food eaten from 10 AM - 2 PM			
Food eaten from 2 PM - 5 PM			
Food eaten from 5 PM - 8 PM			
Food eaten after 8 PM			

How much choice did you have in selecting your food today?

a. No choices, all my food was served to me.
b. No choices for meals, but some choices for snacks.
c. Limited choice for meals, many choices for snacks.
d. Complete choice for some meals, limited choice for other meals, many choices for snacks.
e. Complete choice of all food eaten today.

APPENDIX 4

DATE_____

FORM FOR RECORDING NUTRIENT INTAKES

Food	Approximate Measure or Weight	Energy* (kcal)	Protein† (g)	Fat† (g)	Fatty Acids† (g)			Carbo-hydrate† (g)	Cal-cium* (mg)	Iron‡† (mg)	Vitamin A* (IU)	Thia-min‡† (mg)	Ribo-flavin‡† (mg)	Niacin† (mg)	Ascorbic Acid† (mg)
					Saturated (total)	Oleic	Linoleic								
TOTAL															

*Compute these values to the nearest whole number.
†Compute these values to one decimal place.
‡Compute these values to two decimal places.

APPENDIX 5

*Compute these values to the nearest whole number.
†Compute these values to one decimal place.
‡Compute these values to two decimal places.

SUMMARY OF FOOD INTAKE

	Energy* (kcal)	Protein† (g)	Fat† (g)	Fatty Acids† (g) Saturated (total)	Oleic	Linoleic	Carbohydrate† (g)	Calcium* (mg)	Iron‡ (mg)	Vit. A* (IU)	Thiamin‡ (mg)	Riboflavin‡ (mg)	Niacin† (mg)	Ascorbic Acid† (mg)
A. Nutrient Intake														
Day 1														
Day 2														
Day 3														
B. TOTAL (3 days)														
C. Mean (average) nutrient intake from food and beverage.	Δ													
D. NRC Recommended Allowances, 1974 (SEE TEXT, inside front cover)														
E. Percent of RDA you ate. TEXT, p. 588														
F. Food eaten contributing the most of the nutrient														
Frequency with which you usually eat it.														
G. Nutrient supplements if regularly used.														

H. Distribution of kilocalorie intake: SEE TEXT, p. 589.

ROUND ALL FIGURES TO NEAREST WHOLE NUMBER

Mean Intake						
Protein	gm	x 4 kcal =	kcal from protein	+ mean kcal x 100 =		% from protein
Fat	gm	x 9 kcal =	kcal from fat	+ mean kcal x 100 =		% from fat
Carbohydrate	gm	x 4 kcal =	kcal from cho	+ mean kcal x 100 =		% from cho
Alcohol	gm	x 7 kcal =	kcal from alcohol	+ mean kcal x 100 =		% from alcohol
			Δ Total kcal			% TOTAL**

Δ NOTE: These figures should agree with 100 kcal.
**If this figure does not total approximately 100%, you have an error.

APPENDIX 6

NUTRITION ATTITUDE PRETEST

FOR THE FOLLOWING STATEMENTS, PLEASE INDICATE THE EXTENT OF YOUR AGREEMENT OR DISAGREEMENT BY CHECKING IN THE APPROPRIATE COLUMN.

(Values in () are the values assigned in scoring responses to statements.)

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. There is no way for the body cells to differentiate between synthetic vitamins and natural vitamins, so both forms have equal potency and usefulness in the body.	(5)	(4)	(3)	(2)	(1)
2. Nutrition is important to me and one should not be careless about it.	(5)	(4)	(3)	(2)	(1)
3. Everyone should take vitamins just to be sure.	(1)	(2)	(3)	(4)	(5)
4. When eaten at 8:00 a.m., cake and a soft drink would be considered a meal.	(1)	(2)	(3)	(4)	(5)
5. Because they are such fattening foods, bread and potatoes must be avoided on weight reduction diets.	(1)	(2)	(3)	(4)	(5)
6. Organically grown products have better flavor and health-giving properties than commercial products.	(1)	(2)	(3)	(4)	(5)
7. The Basic Four Food Groups are the only usable tools for planning an adequate diet.	(1)	(2)	(3)	(4)	(5)
8. Knowing something is "good for me" has little or no influence on what I choose to eat.	(5)	(4)	(3)	(2)	(1)
9. Man-made vitamins are just as good as natural vitamins found in foods	(5)	(4)	(3)	(2)	(1)
10. I feel the foods I eat now will affect my future health.	(1)	(2)	(3)	(4)	(5)
11. I feel that as long as I am maintaining my weight, I don't have to worry about nutrition.	(1)	(2)	(3)	(4)	(5)
12. Health foods contain more nutrients than regular foods because they are less refined and processed.	(1)	(2)	(3)	(4)	(5)
13. In my opinion, the best advice when eating away from home is to avoid the unknown.	(5)	(4)	(3)	(2)	(1)
14. When eaten at 10:00 p.m., pizza and beer would be considered a meal.					

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
15. High protein foods such as meat and fish contain practically no calories.	(1)	(2)	(3)	(4)	(5)
16. I feel that if I drink milk, I don't have to worry about nutrition.	(1)	(2)	(3)	(4)	(5)
17. Health foods enhance longevity.	(1)	(2)	(3)	(4)	(5)
18. I usually will not taste a food if its appearance is similar to something I dislike.	(1)	(2)	(3)	(4)	(5)
19. I think traditional ways of preparing food are the best ways.	(1)	(2)	(3)	(4)	(5)
20. I just don't have time to think much about nutrition.	(1)	(2)	(3)	(4)	(5)
21. A calorie is a fatty substance found in a food which causes weight gain.	(1)	(2)	(3)	(4)	(5)
22. Learning the basic ideas in nutrition will probably alter my personal eating habits very little.	(1)	(2)	(3)	(4)	(5)
23. Even if I take vitamins, I feel that I should be concerned about the foods I eat.	(5)	(4)	(3)	(2)	(1)
24. As long as the doctor doesn't say anything to me about nutrition, I don't think I need to worry about it.	(1)	(2)	(3)	(4)	(5)
25. My food has so many vitamins added that I don't have to bother about nutrition.	(1)	(2)	(3)	(4)	(5)
26. I am concerned about eating nutritious foods throughout the day.	(5)	(4)	(3)	(2)	(1)
27. Nutrition is not so important to me as long as I eat a lot of food.	(1)	(2)	(3)	(4)	(5)
28. Children should eat what is on their plate; mother knows best.	(1)	(2)	(3)	(4)	(5)
29. Restricting my meal patterns to familiar foods ensures that I enjoy what I eat.	(1)	(2)	(3)	(4)	(5)

9/14/79

NUTRITION KNOWLEDGE - PRETEST

SELECT THE ONE BEST RESPONSE AND CIRCLE THE APPROPRIATE LETTER.
(Correct answer is underlined)

1. What is a kilocalorie?

   a. a measurement of the energy value in foods
   b. a measurement of the vitamin content in foods
   c. a way of measuring body fatness
   d. the amount of fat in foods

2. Which of the following minerals may be deficient in the soil, thereby resulting in endemic goiter?

   a. calcium
   b. iodine
   c. iron
   d. nitrogen

3. Which of the following has a high caloric density and provides 9 kilocalories per gram?

   a. alcohol
   b. carbohydrates
   c. lipid
   d. proteins

4. According to recent dietary surveys, which nutrients are most likely to be deficient in the diets of adult American males?

   a. protein and iron
   b. vitamin E and vitamin C
   c. calcium and vitamin A
   d. riboflavin and niacin

5. According to recent dietary surveys, which nutrients are most likely to be deficient in the diets of American females?

   a. lipids and vitamin E
   b. riboflavin and protein
   c. calcium and iron
   d. protein and vitamin C

6. Which nutrient contains carbon, oxygen, hydrogen, and nitrogen?

   a. carbohydrates
   b. lipids
   c. proteins
   d. water

7. Which nutrient does NOT provide energy?

   a. carbohydrates
   b. lipids
   c. proteins
   d. vitamins

(OVER)

8. What is the major criticism of the use of Basic 4 Food Groups as a guide in dietary planning?

a. high in kilocalories and therefore promotes obesity
b. too difficult to be useful to most Americans
c. not possible to achieve a well-balanced diet using it as a guide
d. oversimplifies nutritional needs resulting in possible deficiencies.

9. Which of the following carbohydrates does not provide utilizable energy for humans?

a. cellulose
b. glucose
c. glycogen
d. fructose

10. If trying to increase the amount of fiber in your diet, which food would you choose?

a. apple juice
b. tossed salad
c. potato chips
d. yogurt

11. Which of the following statements is true about cholesterol?

a. a harmful substance which should be eliminated from the diet
b. found only in foods of animal origin
c. useful in providing satiety value in the diet
d. another name for a saturated fat

12. What are the fundamental structural units of protein called?

a. amino acids
b. monosaccharides
c. fatty acids
d. glucose

13. Which of the following is true of nonessential amino acids?

a. are not needed by the body
b. can be synthesized by the body
c. must be provided in the diet
d. required only during growth periods

14. What might a weight reduction diet which was extremely low in fat lack?

a. amino acids
b. vitamin C and folacin
c. satiety value
d. fiber

15. Which of the following statements is true about people who have lactose (milk sugar) intolerance?

a. are allergic to milk protein
b. must avoid all milk products
c. often tolerate small amounts of milk
d. will not react to large doses of pure lactose

16. Which of the following is an example of complementary proteins?

a. baked beans and cornbread
b. 3 bean salad
c. peanut casserole (peanuts, almonds, beef broth, potatoes)
d. yams and sweet potatoes with brown sugar and butter

17. The increased amount of processed and ready prepared foods in American diets may result in low intakes of which nutrient? (due to processing loss)

a. iron
b. calcium
c. folic acid
d. vitamin D

18. Which of the following substances are required for normal clotting of the blood?

a. calcium and phosphorus
b. calcium and vitamin D
c. calcium and vitamin K
d. sodium and potassium

19. Which of the following meats is a good source of vitamin A?

a. pork chop
b. hamburger
c. lean fish
d. liver

20. A well-trained athlete will need extra amounts of which one of the following items?

a. protein
b. kilocalories
c. carbohydrates
d. vitamin C

21. Nutrient labeling regulations require that manufacturers reveal which of the following?

a. grams of sodium in product
b. cholesterol content of product in grams
c. % of saturated fats
d. grams of protein

(OVER)

30. Which nutrient is involved in muscle contraction, skeletal integrity, and nerve impulse transmissions?

a. vitamin B_6
b. phosphorus
c. calcium
d. iron

31. The Recommended Dietary Allowances (RDAs) are levels of intake of essential nutrients

a. adequate to meet the requirements of every individual
b. identical to the U.S. Recommended Daily Allowances (USRDA)
c. adequate to meet the known nutritional needs of almost all healthy persons
d. the amounts of nutrients needed per person in the national food supply

32. Which nutrient is necessary for the formation of hemoglobin?

a. iron
b. iodine
c. calcium
d. vitamin A

33. What is the current recommended weight gain during pregnancy?

a. 10-15 lbs.
b. 17-22 lbs.
c. 22-27 lbs.
d. 30-35 lbs.

34. What happens to protein that is consumed in excess of immediate body needs for protein?

a. converted to energy sources and urea
b. excreted as protein molecules by way of urine
c. stored as protein molecules in the liver and muscle
d. totally converted to glycogen storage in the liver

35. A balanced and varied American diet of 2000 calories daily is likely to how nearly meet the iron needs of a 16 year old girl?

a. almost always fulfill her needs.
b. greatly exceed the Recommended Dietary Allowance (RDA) in most cases.
c. will fulfill the Recommended Dietary Allowance (RDA) only if the diet follows the Basic 4.
d. will not meet her needs unless liver and iron fortified cereals are often included

36. Which of the following people do you consider to be a reputable authority on nutrition?

a. Robert Atkins
b. Adelle Davis
c. Jean Mayer
d. Linus Pauling

(OVER)

22. If a diet were extremely low in fat, which of the following nutrients might be absorbed in insufficient amounts?

a. calcium
b. folacin
c. vitamin D
d. thiamin

23. Which of the following foods will provide the most vitamin C?

a. ½ C. cabbage
b. ½ C. corn
c. ½ C. carrots
d. 1 apple

24. Which of the following vegetables is a good source of vitamin A?

a. white potatoes
b. corn
c. sweet potatoes
d. green peas

25. Which one of the following nutrients would partially be destroyed if chopped broccoli were cooked in excess water?

a. vitamin C
b. vitamin A
c. vitamin E
d. iron

26. Which of the following is true of nutrient labeling?

a. is required on all food products in interstate commerce
b. is required on all packaged foods
c. is optional for the manufacturer
d. is required if nutritional claims are made about a product

27. Which vitamin aids in the prevention of night blindness?

a. vitamin A
b. thiamin
c. vitamin D
d. folacin

28. Which nutrient functions in collagen formation and iron absorption?

a. calcium
b. vitamin C
c. thiamin
d. vitamin A

29. Which nutrient facilitates absorption and utilization of calcium and phosphorus?

a. iodine
b. iron
c. vitamin D
d. vitamin E

37. Which of the following is true about the statement:
Large intakes of vitamin C (1-2 grams per day) will prevent the common cold.

a. most research supports this position
b. most research does NOT support this position
c. there is little research on this subject

38. Which of the following foods would contribute the most calories to the diet?

a. 10 potato chips
b. 1 baked potato
c. 3 oz. steak, trimmed of visible fat
d. 8 oz. whole milk

39. Which of the following foods has the greatest amount of iron?

a. 1 pint whole milk
b. 1/2 C. orange juice
c. 3 oz. tuna fish
d. 3 oz. lean beef

40. What are the U.S. Recommended Daily Allowances (USRDA)?

a. higher than the Recommended Dietary Allowances (RDAs) for most Americans
b. identical to the Recommended Dietary Allowances (RDAs)
c. lower than the Recommended Dietary Allowances for most Americans
d. Minimum amounts necessary to prevent deficiency diseases--the same as the MDR

JS:nmd
FSNFSA
9/11/79

APPENDIX 7

Milk Products

Foods	Serving sizes
Hard cheese	1 serving≥1/2 oz. and<1 1/2 oz.
Soft cheese	1 serving≥1 oz. and<2 oz.
Cottage cheese	1 serving≥1/2 C. and<1 1/2 C.
Yogurt	1 serving≥1/2 C. and<1 1/2 C.
Ice cream	1 serving≥1/2 C. and<1 1/2 C.
Milk shake	1 serving≥1/2 C. and<1 1/2 C.
Ice cream bar	1 serving≥1 and<3

Meat Products

Meat, poultry, fish	1 serving≥1 oz and<4 oz.
Eggs	1 serving≥1 and<3
Sausage and luncheon meat	1 serving≥1 slice and<3 slices
Bacon	1 serving≥1 slice and<4 slices
Ribs	1 serving≥4 oz. w/bones and<24 oz. w/bones

Legumes

Beans	1 serving≥1/2C. and<1 1/2 C.
Nuts	1 serving≥1 oz. and<3 oz.
Peanut butter	1 serving≥1 Tbsp. and<4 Tbsp.
Sunflower seeds	1 serving≥1 oz. and<3 oz.
Soy bean curd	1 serving≥1 oz. and<4 oz.
Fried bean curd	1 serving≥1 oz. and<3 oz.
Vegelink	1 serving≥1 and<3

Foods	Serving sizes
Fruits	
Raw fruit	1 serving≥1/4 C. or 1/2 fruit and <1 C. or 2 fruits
Cooked or canned fruit	1 serving≥1/4 C. and<1 C.
Melons (cantalope, honeydew)	1 serving≥1/4 melon and<1/2 melon
Raw Vegetables	
Any raw vegetables	1 serving≥1/4 C. and<1 C.
Tossed salad	1 serving≥1/2 C. and<2 C.
Alfalfa sprouts	1 serving≥1/2 C. and<2 C.
Cooked Starchy Vegetables	
Corn	1 serving≥1/4 C. or 1/2 vegetable and<1 C. or 2 vegetables
Potatoes	1 serving≥1/4 C. or 1/2 vegetable and<1 C. or 2 vegetables
French fries	1 serving≥5 fries and<25 fries
Cooked Other Vegetables	
Non-starchy vegetables	1 serving≥1/4 C. or 1/2 vegetable and<1 C. or 2 vegetables
Tomato sauce	1 serving≥1/2 C. and<1 1/2 C.
Mixed vegetables	1 serving≥1/2 C. and<1 1/2 C.
Bread	
Loaf bread	1 serving≥1 slice and<3 slices
Crackers	1 serving≥2 crackers and<8 crackers
Bread crumbs	1 serving≥1/4 C. and<1 C.
Bagel	1 serving≥1 and<3

Foods	Serving sizes
	Bread (continued)
Bran muffin	1 serving≥1 and<3
Corn fritters	1 serving≥2 and<8
Pancakes	1 serving≥2 and<5
Waffles	1 serving≥2 squares and<4 squares
	Cereal
Breakfast cereal	1 serving≥1/2 oz. and<2 oz.
Rice	1 serving≥1/2 C. and<2 C.
Grits	1 serving≥1/2 C. and<1 1/2 C.
Wheat germ	1 serving≥1 Tbsp. and<4 Tbsp.
	Pasta
Pasta	1 serving≥1/2 C. and<2 C.
	Desserts
Cookies	1 serving≥2 and<5
Marshmallows	1 serving≥6 and<15
Cake	1 serving≥1 slice and<2 slices
Pie	1 serving≥1 slice and<2 slices
Snack cakes	1 serving≥1 and<3
Pudding	1 serving≥1/2 C. and<1 C.
Candy bar	1 serving≥1/2 and<2
Jello	1 serving≥1/2 C. and<2 C.
Sherbet	1 serving≥1/2 C. and<2 C.
Granola bar	1 serving≥1 bar and<3 bars

Foods	Serving sizes
Desserts (continued)	
Chocolate	1 serving≥1 oz. and<3 oz.
Popsicle	1 serving≥1 and<3
Candy	1 serving≥1 oz. and<4 oz.
Doughnuts	1 serving≥1 and<3
Cupcakes	1 serving≥1 and<3
Salty Snacks	
Potato chips	1 serving≥1 oz. and<3 oz.
Cheese snacks	1 serving≥1 oz. and<3 oz.
Nacho chips	1 serving≥1 oz. and<3 oz.
Popcorn	1 serving≥1 C. and<4 C.
Fluid Milk	
All fat levels of milk	1 serving≥1/4 C. and<2 C.
Hot chocolate	1 serving≥1/2 C. and<2 C.
Fruit and Vegetable Beverages	
Fruit and vegetable juices	1 serving≥1/4 C. and<10 oz.
Apple cider	1 serving≥1/4 C. and<10 oz.
Tea and Coffee	
Tea	1 serving≥1/2 C. and<2 C.
Coffee	1 serving≥1/2 C. and<2 C.
Carbonated Beverages	
Any carbonated beverages	1 serving≥1/4 C. and<2 C.

Foods	Serving sizes
Other Beverages	
Tang	1 serving≥1/2 C. and<2 C.
Kool-aid	1 serving≥1/2 C. and<2 C.
Gatorade	1 serving≥1/2 C. and<2 c.
Fats	
Margarine	1 serving≥1 tsp. and<2 Tbsp.
Butter	1 serving≥1 tsp. and<2 Tbsp.
Salad dressing	1 serving≥1 Tbsp. and<3 Tbsp.
Sour cream	1 serving≥1 Tbsp. and<3 Tbsp.
Whipped cream	1 serving≥1 Tbsp. and<3 Tbsp.
Cream	1 serving≥1 tsp. and<3 Tbsp.
Gravy	1 serving≥2 Tbsp. and<5 Tbsp.
Hollandaise sauce	1 serving≥2 Tbsp. and<5 Tbsp.
Sugars	
Table sugar	1 serving≥1 tsp. and<1 Tbsp.
Syrups	1 serving≥1 Tbsp. and<4 Tbsp.
Jelly or jams	1 serving≥1 Tbsp. and<3 Tbsp.
Honey	1 serving≥1 Tbsp. and<4 Tbsp.

Foods	Serving sizes	Food group equivalents
Tomato soup	1 serving≥1 C. and<2 C.	1 cooked other vegetable
Chili w/meat	1 serving≥1/2 C. and<2 C.	1 meat
Chili w/beans	1 serving≥1 C. and<2 C.	1 legume
Chili w/meat and beans	1 serving≥1 C. and<2 C.	1 legume, 1 meat
Leek soup	1 serving≥2 C. and<4 C.	1 cooked other vegetable
Vegetable soup	1 serving≥1 C. and<2 C.	1 cooked other vegetable
Vegetable w/beef soup	1 serving≥1 C. and<2 C.	1 cooked other vegetable and 1 meat
Chicken noodle soup	1 serving≥1 C. and<2 C.	1 meat, 1 pasta
Cream of mushroom Cream of chicken	1 serving≥1 C. and<2 C. (if prepared w/milk)	1 milk product
Tuna salad	1 serving≥1/4 C. and<1 1/2 C.	1 meat
Pizza	1 serving≥2 slices and<4 slices	1 bread, 1 milk product, 1 meat (if meat is specified)
	2 servings≥1/2 pie and <1 pie	2 bread, 2 milk product, 1 meat, 1 cooked other vegetable
Tortillas	1 serving≥1 and<3	1 bread
Spaghetti	1 serving≥1 C. and<2 C.	1 pasta, 1 cooked other vegetable
Chicken pot pie	1 serving≥1 C. and<2 1/2 C.	1 meat, 1 cooked other vegetable, 1 bread
Beef burritos	1 serving≥1 and<3	1 bread, 1 meat
Tacos	1 serving≥1 and<2	1 bread, 1 meat
Chicken and Dumplings	1 serving≥1 C. and<2 C.	1 bread, 1 meat
Macaroni and cheese	1 serving≥1 C. and<2 C.	1 pasta, 1 milk product
Beef stew	1 serving≥1 C. and<3 C.	1 meat, 1 cooked vegetable, 1 cooked starchy vegetable

APPENDIX 8

Card No. _____ (Col. 1)
I.D. Nos. _____ (Col. 2-7)
Day No. _____ (Col. 8)
Gender _____ (Col. 9)

	Blank	MK	Mt	L	F	CS V	CO V	R V	Br	C	P	D	SS	Mk B	FV B	TC B	AB		C B	O B
Column Nos.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Before 10 A.M.																				
Column Nos.	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
10 A.M. - 2 P.M.																				
Column Nos.	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
2 P.M. - 5 P.M.																				

Card No. _____ (Col. 1)
I.D. Nos. _____ (Col. 2-7)
Day No. _____ (Col. 8)
Gender _____ (Col. 9)

	Blank	Mk	Mt	L	F	CS V	CO V	R V	Br	C	P	D	SS	Mk B	FV B	TC B	AB		C B	O B
Column Nos.	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
5 P.M. - 8 P.M.																				
Column Nos.	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
After 8 P.M.																				

Total added

	Blank		Fat
Column Nos.	50	51	52

VITA

Jennifer Fugate Hernon was born in Knoxville, Tennessee on March 20, 1958. Her parents are James T. Fugate and Anna Belle Shipley Fugate of Tazewell, Tennessee. She has one sister, Emmaly Fugate. The author grew-up in Tazewell, Tennessee and graduated from Claiborne County High School. In June 1976, she began attending The University of Tennessee, Knoxville. She received a Bachelor of Science degree in Home Economics in December of 1980.

In January 1981, she accepted a graduate assistantship at The University of Tennessee, Knoxville and went on to study toward a Master of Science degree in Food Science. During her academic career she was a student member of The Institute of Food Technologists and a member of the Graduate Student Council. The author was married to Dennis A. Hernon on March 20, 1982.