EATING BEHAVIOR AND NUTRIENT INTAKE OF ELDERLY AND YOUNG ADULTS

By

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Bachelor of Science

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December, 1983

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
July, 1996

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OF ELDERLY AND YOUNG ADULTS

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ACKNOWLEDGMENTS

I would like to first express appreciation to my major professor, Dr. Christa Hanson for her guidance and assistance in the course of this study and preparation of this manuscript. I also want to extend appreciation to Dr. Andrea Arquitt and Dr. Janice Hermann for serving on my graduate committee. I also extend appreciation to Dr. Fred Owens for his assistance with the SAS Program, data analysis and input for this project. All professors involved had helpful suggestions.

I highly value the advice, data input and moral support that was provided by other graduate students and undergraduate students. These are the people in the ranks that probably get the least amounts of "thanks" but they always earn it. Support personnel run the office, the professors, the students and the University - thanks to Pat (who is very kind to refrain from running when he sees me), and special thanks to Julie and Neva for letting me "vent".

I could not have completed this project without the assistance and support of my mother and both my sisters, Lavona Smith and Marce Olsen Lester, typists that they are. My employer, Three Feathers Associates, has been extremely supportive of completion of this project - days left early from the office and days off take away from work, but all I got from Three Feathers Associates was support and my pay - many "kudos" to TFA.

My warmest and most heartfelt thanks goes to my husband and partner in life of almost 13 years, John M.T. Sharp, whose assistance via discussion, data manipulation, software usage and problem solving, listening to me complain, and missing out on many movies because I could not go with him, as well as just wonderful support was the key for completion of this project.

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NOMENCLATURE

ADA	American Dietetics Association
Bev	Beverages
BMI	Body Mass Index
Ca	Calcium
CHD	Coronary Heart Disease
CHO	Carbohydrates
Chol	Cholesterol
Com	Complex
cm	Centimeters
cond	Condiments
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
Eld	Elderly
ESAI	Estimated Safe and Adequate Intake
FA	Fatty Acid
fat	Fattened
Fe	Iron
FGP	Food Guide Pyramid
g	Grams
grain	Grain-type
HDL	High Density Lipoprotein
IA	Interaction
IBW	Ideal Body Weight
IDDM	Insulin dependent Diabetes Mellitus
IU	International Units
K	Potassium
kcal	Kilocalories
kg	Kilograms
LDL	Low Density Lipoprotein
LF	Low Fat
mcg	Micrograms
mg	Milligrams
MUFA	Monounsaturated Fatty Acids
Na	Sodium
ND	Non-dairy
Nia	Niacin
NIDDM	Non-insulin dependent Diabetes Mellitus
NIH	National Institute of Health
Num	Number
Oth	Other
P	Phosphorus
Pro	Protein
PUFA	Polyunsaturated Fatty Acids
RDA	Recommended Dietary Allowance
RE	Retinol Equivalents
Ribo	Riboflavin
SEm	Standard Error of the Mean
SFA	Saturated Fatty Acids
Subj	Subjects
sweet	Sweetened
Thia	Thiamin
Tot	Total
Vit	Vitamin
VLDL	Very Low Density Lipoprotein
Yng	Young

LIST OF SYMBOLS

"	Inches
#	Pounds
%	Percent
♂	Males
♀	Females
↑	High

CHAPTER I

INTRODUCTION

Food choices are abundant in Westernized societies. In the United States, many foods available are very appetizing and high in fat, making the food source more energy dense (Pi-Sunyer, 1994). Typically American's do not eat a variety of foods and make few choices from the thousands of foods that are available (Willett, 1994). People generally eat based on family customs, their own traditions, their personal habits and their social environment. Americans tend to consume too many kilocalories compared to energy expenditure. This is exemplified by the statistics of obesity and weight gain in US adults (Kuczmarski, et al., 1994). However, when choosing diets that are excessive in calories in relation to energy needs, many people do not select diets adequate in nutrients.

The selection of foods, including a less nutrient dense selection, may have a dramatic impact on our health and well being. Many studies have shown associations between micronutrients and health and disease (Pi-Sunyer, 1994; USDHHS, 1988). The way foods are combined for meals and snacks, the types of foods chosen, and serving sizes are all important in health and well-being because these choices directly affect nutrient content in the diet.

The American public has been given information concerning various concepts regarding healthy eating, including: lowering fat in the diet, increasing fiber, and consuming appropriate calorie levels to maintain healthy body weight. However, most people cannot correctly identify and categorize those foods or the recommended eating behaviors (USDHHS, 1991). For example, people have been given information that the fat in red meat is highly saturated. They also have received information that they should eat a lower fat diet especially one low in saturated fat. They then combine these two statements and interpret these to mean they should not consume red meat. The also fail to identify other sources of fat in their diet, which can be major contributors to both total fat and saturated fat (NLSMB, 1993). These are examples of some of the ambiguity in nutrition information that results in the inability of the public to consider the merits of individual foods (Watts, et al., 1988; Hansen, et al., 1986).

Significance of Problem

We must have pertinent and accurate tools to correctly utilize dietary assessment. This is necessary to evaluate any associations between dietary habits and health correctly and factually. The current existing methods of dietary analysis that are widely used are suitable for specific conditions, but all methods do have limitations under other conditions. Examples of some of these conditions include the ability of subjects to read or report desired information (i.e. literacy, ability to speak), memory of subjects (i.e. elderly), or whether quantitative or qualitative nutrient information is required (Dwyer, 1994).

The science of nutrition has yet to establish the nutrients that are needed in specified quantities for optimal nutrition - there is a need to increase knowledge in this direction as well as to identify factors (i.e. genetic, environment) that may affect nutritional requirements. Research in this area may help improve scientific insight regarding the role of populations' nutritional behavior (NRC-FNB, 1989). Research in this area should include nutrient requirements of the healthy population spanning all age groups. Optimal nutrition in the very young and the elderly age group has yet to be identified (NRC-FNB, 1989).

Psychological and sociological factors have a great impact on eating behavior (Pi-Sunyer, 1994) yet these are very complex areas to study. Societal concerns and factors that may impact how people make food choices include religion or philosophy; dieting/weight consciousness; household size, marital status; access to resources, and educational level - each can have a profound effect upon food selection (Schwerin, et al., 1981).

Nutrition policy on a local and worldwide basis utilizes research on eating behavior and food selection and their relationships to health. This single concept alone indicates the necessity for accurate dietary assessment. Finally, by identifying patterns or relationships of food choices, we may be able to better educate the public.

Relevance of Research

The importance of this research is related to the significance of the problems of understanding

eating behavior and nutritional status, understanding nutritional requirements for various age groups and conditions, educating members of the public and health care fields, and identifying nutritionally related problems and implementing policies.

Objectives

This research has been designed to evaluate dietary records of young and elderly adults, to determine relationships among food choices and nutrient adequacy, and when available, to determine relationships of dietary intakes to physical measures. Specific objectives are:

1) To determine the association among distinctive food choices and dietary habits.

"Food choices" indicates that one is making a conscious selection of actual foods. Dietary habits indicates that one is consuming foods in a pattern that could include patterns throughout the day, specific patterns at a meal or specific patterns of selection with specific foods. This first objective relates to food choices and dietary habits. This research project investigates the specific food(s) selected or not selected in conjunction with other foods and the patterns of choices made for meals or groups of meals.

2) To determine the variability of food choices and dietary habits.

This may be done by examining the consistency of these patterns or to determine the relationships between food choices and dietary patterns and nutrient intake, anthropometric or biochemical markers.

3) To determine the relationship between food choices/dietary patterns and anthropometric or biochemical markers.

This third objective defines how food selection or dietary patterns may be associated with anthropometric or biochemical markers, using regression analysis.

Thus, specific objectives were to:

1) Evaluate food selection/patterning to assess the relationships between food choices and dietary patterns.

2) Determine the nutrient intake specific for each group (age, gender and age-gender)and determine the adequacy of the intake.

3) Determine relationships between food group patterns and nutrient intakes to blood chemistries in the elderly group and anthropometries in the young adult group.

Hypothesis

1) There will be no significant difference between food choice patterns (relationships among specific food choices and dietary habits) between elderly adults and young adults, males and females, or any age-gender interactions.

2) There will be no significant difference in the constancy of such habits, between elderly adults and young adults, males and females, or any age-gender interactions.

3) There will be no significant difference in dietary patterns related to nutrient intake between elderly adults and young adults, males and females, or related to food group intakes, or any age-gender interactions.

4) There will be no relationship of physical markers and food groups intake.

Assumptions and Limitations

As for any study, there are various assumptions and limitation that are required in order to do the research.

Limitations

Limitations of this research project are as follows:

1) Subjects were volunteers. This volunteer process for the elderly appeared to solicit subjects that were more interested in nutrition. The use of the younger adult subjects had limitations in that these subjects were solicited from a Freshman level nutrition course using their course work for intake records.

2) Self-reported diet records have questionable accuracy, but these were used due to the cost and difficulty of other methods that may be more accurate (i.e. observed intake with diet recording).

Even though respondents were instructed on accurate record keeping, self-reporting tends to result in errors in listing miscellaneous foods such as sauces, salad dressings and margarine and determination of serving sizes.

3) Because diet records that had been previously gathered were used, the data was gathered from each age group at different times. Only the elderly had food intake records that may help compensate for seasonal variation. Block and Hartman (1989) indicated that seasons or different times of the year have an affect upon an individuals choices of foods and thereby affect nutrient intake. Food intake records should therefore by collected over a period of time to better represent "normal" intake. Only the elderly subjects recorded intake of foods to compensate for these seasonal variations. As the young subjects did not collect data in this manner, there is the likelihood that the data does not represent "usual" intake for this age group.

4) For the elderly group, the food intake records did not ask for time that foods were consumed, thus, it was difficult to determine the foods that were parts of meals and those that were actually snacks. Meal and snack divisions were based upon visual patterns of recording, using 3 concurrent days as a basis to assist with divisions.

5) Ideally, complete nutrient analysis would be available for all foods, but currently this is unrealistic. This may affect the completeness of nutrient data. New foods are being developed constantly, and many foods (especially fast foods and convenience items) have missing values for various nutrients in nutrient data bases. Some nutrients have not been analyzed for various foods. Missing values show nutrient intake to be lower than the actual consumed values.

6) Poor descriptions of foods consumed confound nutrient analysis further. Composition of foods from restaurants or home may differ from the data base values.

7) Physical data were only available for young subjects while biochemical data were only available for elderly subjects. To better compare age groups, it would have been beneficial to have had both physical data and biochemical data for both age groups.

Assumptions

Based upon the above limitations the researchers acknowledged the following assumptions for this study:

1) The subjects recorded foods and beverages consumed in the diet records completely and accurately.

2) The fiber, vitamin, mineral, macronutrient and calorie values used in the "Food Processor 6.0" computer program were accurate.

3) The dietary records represented usual intake for the respondents.

4) All subjects were on a regular, free choice diet.

5) There are assumptions for the data analysis. These assumptions include that:

   a. The sample populations are representative of the populations that the research is about or the populations about which the research will infer;

   b. The variables (being correlated or regressed), each should be of a normal distribution;

   c. For every value of each variable, the distribution of the variable being correlated or regressed has approximately equal variability (homoscedasticity); and

   d. There are linear relationships for the variables being correlated or regressed.

Format of Thesis

This research project has been organized as a manuscript that follows the format specified in the Oklahoma State University Graduate College Style Manual.

CHAPTER II

REVIEW OF LITERATURE

Introduction

This literature review is devised to review diet and its relationship with health, and studies of eating patterns/behavior.

Diet and Health

For many years there has been a search to associate dietary components and chronic diseases (Willett, et al., 1995). Only recently has the identification of essential and adjunctive nutrients resulted in emphasis on food consumption and nutrient relationships to chronic disease and health. CVD and cancer are still the leading causes of US disease mortality (Muggli, 1992). In 1989, almost 43% of US deaths were related to CVD and almost 23% were related to cancer (Barber and Harris, 1994). Nutritional components have been related to at least four of the ten leading causes of death (some types of cancer, cardiovascular disease (CVD), non-insulin dependent diabetes mellitus (NIDDM) and osteoporosis) (U.S. Preventive Services Task Force, 1989; Willett, et al., 1995; Willett, 1994). Willett (1994) indicates that even though we have found some food groups to exert a protective effect upon health and disease, the specific nutritional components have yet to be identified - this author does feel strongly about the fact that the typical American diet is not optimal and that there is much latitude for preventing diseases based upon improving the diet.

Cardiovascular Disease

Heart disease has been a prevalent disease in the United States, with varying rates in different sub-populations. Anderson and Halliday (1979) indicated that the incidence of CHD increased strikingly during the first half of the 20th century. There has been an immense amount of investigation into heart disease, especially of nutritional effects. Investigations have studied the links between macronutrients, micronutrients and other "non-nutritive" components of foods and foodstuffs such as

alcohol, dietary cholesterol and phytochemicals.

General Dietary Considerations and Cardiovascular Disease. The U.S. Dietary Guidelines (USDHHS, 1995) and the Food Guide Pyramid have been developed based upon research that indicates a high complex carbohydrate, low fat diet is a healthy diet. Farchi, et al. (1994), indicated that those subjects with the lowest mortality rate were those that consumed more than 2800 kilocalories per day, with carbohydrates providing more than 41% of the total calories, proteins providing more than 9%, saturated fats providing 16-23%, and alcohol providing 13-19% of the calories.

Jenkins, et al. (1995) studied the effects of nibbling (17 meals per day) versus a three-meal-a-day eating pattern. In this crossover designed study, they found that the nibbling eating pattern resulted in lower LDL-cholesterol, non-HDL-cholesterol and apolipoprotein B. These researchers also found that there were no differences in total cholesterol to HDL cholesterol ratio between the nibbling and three-meal-a-day eating patterns.

A study that reviewed vegetarians, semi-vegetarians and omnivarians (those who ate animal flesh and non-animal foods) provided information on risks for CVD in African Americans (Melby, et al., 1994). When looking at hypertension, the vegetarians only had a hypertension rate of 16% versus 35.7% for the semi-vegetarians and 31.1% for the omnivarians. The vegetarians also had lower levels of total serum cholesterol, LDL-cholesterol, triglycerides, total cholesterol to HDL-cholesterol ratios and LDL-cholesterol to HDL-cholesterol ratios.

Maryniuk (1993) provides information that there is no single diet that can be prescribed to be protective for CVD for all individuals with DM. Individuals react differently to diets as well as to acceptability of a diet. A prescription of lower fat, higher carbohydrate diet may be appropriate for some, while others may benefit from a lower carbohydrate, higher monounsaturated FA diet. The differences may lie in actual metabolic and physiological differences as well as behavioral differences.

Huijbregts, et al. (1995) use cluster analysis to characterize subjects into high alcohol intake, high meat intake, healthy dietary pattern and high refined sugar intake. The results from this study indicated that those subjects that clustered into the high alcohol intake group had higher HDL-cholesterol levels than the other groups. This group also had approximately a 10% higher hypertension

rate than the other three groups. Those subjects in the high meat intake group had higher HDL-cholesterol levels than those subjects in the high refined sugar group.

Some research has indicated that moderate alcohol intake is associated with a decreased risk of CHD (Hennekens, et al., 1987; Moore and Pearson, 1986). Even the U.S. Dietary Guidelines (USDHHS, 1995) address alcohol as possibly having a protective effect on CVD (by the same token, the discussion also warns regarding cancer and alcohol intake).

Manson, et al. (1987) has postulated that as fat is calorically dense, energy balance rather than the actual fat may be a culprit for CHD. Rosser (1993) and Atrens (1994) point out that a lowfat diet can result in lower serum cholesterol levels, but there has been no documentation that this results in decreased mortality from CHD.

Various researchers have provided research that supports that those people who consume lowfat diets have a decreased risk for total mortality, cancer mortality and coronary heart disease (CHD) (Farchi, et al., 1994;. Hellenius, et al., 1993; Singh, et al., 1991; Posner, et al., 1993). Singh, et al. (1991) questioned the possibility that when healthier dietary changes occur, there may also be concomitant modifications of other risk factors (i.e. exercise).

Opposing the opinions related above, Atrens (1994) questions the prudence of a lowfat diet (and cholesterol reduction) as actually being beneficial or having a defined effect upon CVD. Atrens (1994) discusses the fact that much contradiction has occurred from the research relating lowfat diet and cholesterol reduction to CVD; the author feels that there have been no definite relationships identified and that there have been various studies showing positive, negative and random relationships.

The study by Nicklas, et al. (1995), from a review of Bogalusa Heart Study data considered meat intake as a food group and its association with CVD risk factors. The results suggested that those subjects with a higher meat intake did not have different values for blood lipids, lipoproteins or anthropometric measures than those subjects that consumed less meat. This is a more moderate view, suggesting that there may be interactions of nutrients related to CVD/CVD risk. Both McNamara (1992) and Atrens (1994) indicated that the individuality of every subject (genetics, environmental factors) makes it difficult to say that a single dietary prescription is beneficial.

An interesting study by Mizushima and Yamori (1992) presented information that indicates that

an increase in fat and protein in the Japanese diet has been associated with increased longevity. From 1955 to 1988, daily mean protein intake increased from 69.7 grams to 79.2 grams per day, and daily mean fat intake increased from 20.3 grams to 58.3 grams. However, Arbeit, et al. (1992), however, presented that energy intake does effect the risk of CVD indicating inappropriate calories for energy expenditure increased risk.

Fiber and CVD: Various studies have been done to research fiber's association with CVD. The generally accepted guidelines for professionals has been to encourage a high fiber diet to assist with controlling CVD with various studies supporting these guidelines (Simon, 1994). Others have discussed that either inadequate fiber intake is associated with increased risk for CVD or increased fiber intake decreases CHD risk (Morris, et al., 1977; NRC, 1989).

Several recent studies support fiber's positive effects upon CVD. Kashtan, et al. (1992) and He, et al. (1995) conducted research to look at the effects of insoluble and soluble fibers on blood lipids. Both sets of researcher concluded both types of fiber resulted in reduction of total cholesterol and LDL-cholesterol. However, Kashtan, et al. (1992) indicated that soluble fiber resulted in a larger reduction than did insoluble fiber. Ullrich, (1987) on the other hand, provided research that indicated that insoluble fibers have little affect upon serum lipid values. Other studies have been conducted that support that soluble fiber is important in decreasing risk for CVD (Kritchevsky, 1987; Ullrich, 1987; Hunninghake, et al., 1994; Anderson, 1993).

In looking at the effects of fiber on CVD, Sacks (1993) questions whether dietary fiber is actually protective against CVD or if higher dietary fiber intake is indicative of a healthier lifestyle that results in decreased risk for CVD.

Phytochemicals and CVD: Phytochemicals as constituents of plant foods, have been investigated for their positive roles in disease prevention. Machlin (1995) in his discussion of high intake of foods rich in antioxidants decreasing risk for CVD, also discusses that there may be factors other than the antioxidants that these foods contain that may actually be the protective mechanism.

Imai and Nakachi (1995) investigated the effects of drinking green tea on CVD as well as on

liver diseases. This research indicated that there was a negative relationship between the intake of green tea and total cholesterol level, triglyceride level, and LDL- and VLDL- cholesterol levels resulting in a decreased "atherogenic index". There also was a positive relationship with HDL-cholesterol level.

Fraser, et al. (1992) indicated that those individuals who consumed nuts four times a week had lower rates of CHD. These authros indicated that the components responsible for the lower rates may be other and/or additive to fat quality (i.e. phytochemicals). Abbey, et al. (1994) provided further information that almonds and walnuts as partial SFA replacements resulted in decreased total plasma cholesterol and LDL-cholesterol.

Other researchers have found favorable responses for decreasing CVD risk by the consumption of soy products. Soy protein has been associated with lowering cholesterol in a study by Anderson, et al. (1995). In this project, daily consumption of 31-47 grams of soy protein resulted in a lower serum total and LDL-cholesterol levels. Lovati, et al. (1987) and Sirtori, et al. (1995) both indicated that the protective effects against CVD of soy products is the protein. These researchers indicated that the soy proteins may actually help in the breakdown and elimination of cholesterol.

Dietary Fats and Cholesterol and CVD: The research on the relationship between fat and CVD has been extensive. Research has included the relationships between various fats (total fat, saturated fats, polyunsaturated fats, monounsaturated fats, omega-3 fatty acids, and trans-fatty acids) and CVD as well as these components' exacerbation of the disease.

Over fifty years ago, dietary cholesterol was associated with arterial lesions in animal subjects (Katz and Stamler, 1953). Other research supporting the relationship of dietary cholesterol and associated arterial lesions has continued (Wissler and Vesselinovitch, 1976; Grundy, et al., 1982).

In 1965, Keys, et al. (1965) and Hegsted, et al. (1965), conducted research that implicated SFAs for increasing total serum cholesterol. Yet, there was contradictory research by one of the same researchers on cholesterolemic effects of SFA. Hegsted, et al. (1965) conducted an original study with conclusions that palmitic acid had less of an effect on cholesterol than myristic acid. Later, McGandy, et al.(1970) conducted a study that indicated myristic and palmitic acids both had similar cholesterolemic effects. Kuller (1994) reviewed dietary SFA's and cholesterol's positive relationship

with atherosclerosis. Kuller (1994) indicated that major factors in atherosclerosis and CHD is the percentage of saturated fat and cholesterol in the diet.

Another set of researchers (Robertson, et al, 1977) examined "ancestrally close" populations (Japanese men living in Japan, Hawaii and San Francisco). Both sets of researchers examined the incidence of CHD and relationships to diet. This study implicated saturated fat as a contributing factor for differences in CHD incidence.

An interesting contrast to what Kato, et al., (1973) and Robertson, et al., (1977) discussed is research by Friend (1967) and Page and Marston (1979). Page and Marston (1979) indicated that there has only been a slight increase in the saturated fat intake while polyunsaturated fat has increased 2-3 fold. Both Bonanome and Grundy (1988) and Wissler and Vesselinovitch (1975) further investigated different saturated fats' effect on serum cholesterol; both indicated that not all SFAs have the same effect upon serum cholesterol. To further support this concept that SFAs have differing affects upon serum cholesterol, several researchers over a period of years have shown that stearic acid (a SFA) did not seem to affect serum cholesterol (Hegsted, et al., 1965; Keys, et al., 1965; Grande, et al., 1970; Bonanome and Grundy, 1988).

Dimmitt (1995) notes that the role of dietary fats in the atheroma process has not been fully explained, yet it does appear that total fat and saturated fats appear to play a positive role with the atheroma process (increasing it). Dimmitt (1995) further indicates that monounsaturated and polyunsaturated fats have a less defined role in CVD. He also notes the classes of fats (SFA, PUFA and MUFA) increase HDL and decrease triglyceride levels when they are isocalorically substituted for carbohydrates. SFA tends to increase LDL-cholesterol, while PUFA and MUFA (PUFA more so) decrease LDL-cholesterol. However, PUFA increases LDL-cholesterol oxidizability. Trans-FAs (originally from PUFAs) may have an adverse effect on LDL, HDL and lipoprotein A which may increase risk for CVD. Dimmitt (1995) also discusses that omega-3 FAs inhibit thrombosis and platelet aggregation as well as lowering blood pressure. In total, Dimmitt describes that the processes associated with these various fats on the atherosclerotic process is not clear.

There have been studies designed to try to identify PUFAs' relationship with CVD.

Lichtenstein (1993) points out that all vegetable oils are not alike. This author indicates that the consumption of hydrogenated vegetable oils may actually have a positive relationship with plasma lipids and CHD risk - the influence of these hydrogenated vegetable oils may be a culprit for increasing risk. While Insull, et al. (1994) compared diets with 3 different sources of PUFA (partially hydrogenated soybean oil, corn oil and sunflower oil) to see their effect upon plasma lipids - all three diets resulted in decreased total cholesterol, LDL-cholesterol and HDL-cholesterol.

One of the recent trends for fat research has been the investigation of omega-3 FAs' relationship with CVD. There has been research and discussion that indicates omega-3 FAs as having negative associations with the atherogenic lipid profile (Leaf and Webber, 1988; Herold and Kinsella, 1986; Mori, et al., 1994) or a positive association with the interference with atherosclerotic plaque formation (Semplicini and Valle, 1994). Other research projects have shown only specific serum components, such as decreased serum triglyceride levels (Harris, 1989; Schmidt and Dyerberg, 1994; Semplicini and Valle, 1994), as having been affected by omega-3 FAs intake. Omega-3 FA intake has also been associated with a positive effect upon platelet function (Leaf and Webber, 1988; Herold and Kinsella, 1986; Schmidt and Dyerberg, (1994), inflammatory response and changes in eicosanoid formation (Leaf and Webber, 1988; Herold and Kinsella, 1986).

Even with the multitude of research indicating positive effects of increased omega-3 FA intake, some researchers have indicated that there are still questionable associations between omega-3 FAs and CVD. Semplicini and Valle (1994) stated some patients have actually shown an increase in LDL-cholesterol and a decrease in HDL-cholesterol. Schmidt and Dyerberg (1994) indicated there is a possibility that omega-3 FAs may increase oxidation of lipoproteins, thereby increasing rise for CVD.

Vitamins/Minerals/Antioxidants and CVD: Various vitamins have been shown to possess antioxidative properties, whether from food sources or from supplements (Abbey, et al., 1993; Niki, 1991; Frie, 1991; Krinsky, 1989; Burton and Ingold, 1984; Bendich and Langseth, 1995; Hunt, et al., 1992; Machlin, 1995; van Poppel, et al., 1994; Acheson and Williams, 1983; Gey, et al., 1993; Gramenzi, et al., 1990; Gaziano, et al., 1990; Palgi, 1981; Burton, 1994; Hallfrisch, et al., 1994); these nutrients include vitamin A/beta-carotene, vitamin C and vitamin E/alpha-tocopherol.

There are several theories for the negative association of antioxidants with CVD. One theory indicates that antioxidants reduce the damage done to LDL-cholesterol by free radical oxidants (Abbey, et al., 1993; Niki, 1991; Frie, 1991; Krinsky, 1989; Burton and Ingold, 1984; Palgi, 1981; Burton, 1994). Other researchers have indicated that vitamin E is not only an antioxidant but also a scavenger that helps to remove LDL-cholesterol from the body (Abbey, et al., 1993; Machlin, 1995). Palgi (1981) suggested that antioxidant vitamins and minerals are likely to act jointly rather than individually to protect against CVD. Burton (1994) discusses the epidemiological evidence that support vitamin E's possible protective role in CVD. In his article, this author discusses that vitamin E is a very good antioxidant in the presence of other antioxidants such as vitamin C, yet when these other antioxidants are not available then vitamin E acts as a pro-oxidant.

As with almost all nutritional research there have been articles that discuss the negatives or lack of protective properties of some of these antioxidants. Hunt, et al. (1992), discuss that even with the positive properties of antioxidants, ascorbic acid oxidation may be a cause of elevated severity of atherosclerosis in those with diabetes. Other researchers such as van Poppel, et al. (1994) found that supplementation with beta-carotene did not effect plasma lipids in male smokers. Princen, et al. (1992) and Reaven, et al. (1993) found that there was no protective effect of beta-carotene for LDL oxidation.

Barber and Harris (1994) discuss that even though many professionals have concluded that antioxidant supplements are appropriate, low levels of antioxidant intake have been associated with CVD. Barber and Harris (1994) further discuss that there has not been a true protective causal relationship found from the research. Furthermore, they discuss that megadose antioxidant supplementation does not have any benefit above and beyond what a moderate intake or supplement can do for antioxidant properties.

Body biochemical markers, other than serum/plasma lipids have been associated with CVD. A high homocysteine level has been discussed as a risk factor for CVD (Pancharuniti, et al., 1994; Kang, et al., 1987; Stabler, et al., 1988; Ubbink, et al., 1993; Brattstrom, et al., 1988; Olszewski, et al., 1988; Massy, et al., 1994; Scandinavian Simvastatin Survival Study Group, 1994). Pancharuniti, et al. (1994) have pointed out that folate and vitamin B12 are required to help decrease homocysteine levels

in the body. Other researcher have provided research that shows supplementation of folate (Ubbink, et al., 1993; Brattstrom, et al., 1988; Olszewski, et al., 1988; Scandinavian Simvastatin Survival Study Group, 1994) and vitamin B12 have helped to decrease homocysteine levels (Ubbink, et al., 1993; Brattstrom, et al., 1988; Olszewski, et al., 1988).

Copper is another mineral that has been researched in relation to CVD. Virtamo, et al. (1985) indicate that there may be a link between risk of CHD and copper. Klevay (1983) hypothesized that lower copper intake increases the risk for CHD, while Kok, et al. (1988) discussed that higher intakes of copper increases the risk. This appraisal of higher risk with higher intake is possibly related to what Strain (1994) and Fox, et al. (1995) discussed; copper can act as an antioxidant in optimal quantities, but in excess it acts as a strong prooxidant.

Kisters, et al. (1993) used oral supplementation of magnesium to see effects upon serum triglyceride levels, finding that magnesium supplementation was associated with decreased triglycerides. Witteman, et al. (1994) used middle aged and elderly females to consider any relationship between magnesium and hypertension. For those subjects with mild to moderate hypertension, magnesium supplementation was associated with decreased blood pressure. Ma, et al. (1995) also provided information associating low serum and dietary magnesium and CVD. Providing further support for the associations of magnesium and CVD, Altura and Altura (1991-2) discussed that at least a normal intake and possibly a higher than normal intake of magnesium is likely to decrease risk for CVD.

Various studies that have been conducted to investigate the relationship of iron to CVD has resulted in contrasting views. Hollan and Johansen (1993) discussed iron as a catalyzer for the release of free radicals, resulting in an association of higher risk for CVD. However, other researchers such as Bendich and Langseth (1995) and Sempos, et al. (1994) discussed an opposing view regarding the relationship of iron and CVD risk. These two sets of researchers not only indicated that the concept that a higher iron status increases risk for CVD is not substantiated, but it is actually shown that there is an inverse relationship with iron status and CVD risk.

In a general mineral study by Sei, et al. (1993), the researcher gathered data from the National Nutritional Survey to study the association of CVD mortality with mineral intake in Japan. Sei, et al, (1993) showed that there was a positive association between mineral intake and cerebral hemorrhage

and cerebral infarction over a 15 year period. It was also interesting to note that mortality from ischemic heart disease had a positive association with mineral intake only for the 1971-1975 time period. This result regarding ischemic heart disease exemplifies that there is an association, but the association does not necessarily mean a cause and effect relationship (positive association with mineral intake only occurred for four years out of the 15 year period).

Other minerals, nutritional or non-nutritional, that have been researched and reviewed for a relationship with CVD have included zinc (Klevay, 1983; Kok, et al., 1988; Koo and Ramlet, 1983), calcium (Preuss, 1993), chromium (Anderson, 1987), lead levels (Schwartz, 1995; Moller and Kristensen, 1993), and sodium and potassium (Arbeit, et al., 1992; Preuss, 1993).

Cancer

Foods and/or specific nutrients have been researched for their either negative or positive association with cancer. Studies have considered individual nutrients and nutrients in combinations. Now there is a strong trend to look at components other than nutrients (i.e., phytochemical) that may decrease risk for diseases. Ip, et al. (1994) even discuss the use of food modification or enhancement to increase agents that are considered anticarcinogens in the foods (i.e. garlic cultivated with selenium fertilization).

General Dietary Considerations and Cancer. Various research has indicated an association between several cancers and diet. The cancers include breast, colorectal, prostatic, pancreatic and uterine (Nixon, 1994; Schapira, 1992; Heber, 1992; Statland, 1992; LaVecchia, 1992). There are indications that 35% of cancer cases are associated with the typical American diet (Bal and Foerster, 1994; Schapira, 1992), and that the dietary pattern in the U.S. may be an important factor in the cause and prevention of cancer (Byers, 1993; Heber, 1992; Statland, 1992)..

Several researchrs discuss the relationship between protein and calorie restriction and cancer (Youngman, 1993; Shigenaga and Ames, 1993). These restrictions affect physiology that inhibits the growth of DNA-damaged tissues, thereby decreasing cancer risk. Weindruch (1992) notes that there is a positive relationship between calorie intake and certain cancers. Despite the research relating diet and

cancer, Winnick (1991) points out that no single nutrient or class of food by itself significantly affects risk for most cancers. Rather, it is the dietary pattern, including calorie balance, or the mix of nutrients and foods that effect cancer risk.

Fats and Cancer: Fats as a macronutrient has received much attention for the relationship of fat intake and cancer. Of the research indicating a connection between fats and cancer, virtually all indicate that there a positive relationship between fat and cancer. Various researchers indicate that there is a positive association with fat intake and cancer (Greenwald, et al., 1995; Nixon, 1994). Erickson and Hubbard (1994) point out that the association of fats with immune function has been ongoing for 20 years - this immune function may be important for cancer prevention, and modification of quantity and quality of FAs may be an important cancer preventative measure.

More than 40 years ago, Tannenbaum and Silverstone (1949) conducted research that indicated the fat intake of rodents affected mammary tumors. In 1975, Armstrong and Doll indicated that for various countries, fat consumption, and morbidity and mortality rates of breast cancer were positively associated. Kuller (1994) discusses that a higher fat intake along with weight gain or obesity may effect sex-steroid hormone metabolism, which may play a role in breast cancer. LaVecchia (1992) has incriminated total fat and possibly saturated fat as having a positive relationship with breast cancer, but LaVecchia also notes that the links are weak and inconsistent. High fat and high meat intake has been associated with colorectal cancer, with the possible mechanism involving SFA (LaVecchia, 1992; Kushi, et al., 1995). However, Mills, et al. (1988) indicated those women who adopted a vegetarian lifestyle at an earlier age actually had a higher risk of breast cancer.

Vitamins/Minerals/Antioxidants and Cancer: Those vitamins and minerals that are currently most associated with exerting a protective effect upon cancer include vitamins A, C and E, and minerals selenium and zinc; these nutrients are considered antioxidants (Hargreaves, et al., 1989). Various studies have shown that a diet high in fruits and vegetables is negatively associated with cancer risk (Statland, 1992; Bjelke, 1975; Machlin, 1995). A diet high in fruits and vegetables would generally be considered also high in several of the antioxidants.

Several studies have investigated diet relationships with lung cancer. Bjelke (1975) indicated

that those men who consumed above average vitamin A had a lower lung cancer morbidity than men with vitamin A intake below average. Kale, et al. (1983) had further follow-up on Bjelke's (1975) study that gave evidence that carotenoid vitamin A rather than preformed vitamin A was more protective against lung cancer. Prior to Bjelke's study (1975), Shekelle, et al. (1981) also indicated that carotenoids again were strongly associated with a decreased risk, while preformed vitamin A intake had no association with the incidence of lung cancer.

Machlin (1995) reviewed that there is much epidemiological evidence that high intake of foods rich in antioxidants (beta-carotene, vitamin E or vitamin C) have been shown to reduce the risk for some cancers. Barber and Harris (1994) discussed that low levels of antioxidant intake has been associated with cancer (due to the increased free radical activity), and that many professionals have concluded that antioxidant supplements are therefore appropriate. But, Barber and Harris (1994) further discussed that there has not been a true protective causal relationship found from the research, and that megadose antioxidant supplementation does not have any benefit above and beyond what a moderate intake or supplement can do for antioxidative properties.

Supporting the research on intake high in antioxidant vitamins, is research that has found a positive association of low plasma levels of antioxidants and cancer. Eichholzer, et al. (1992) used data from a 12 year follow-up of the Prospective Basel Study to look at cancer risk in relation to antioxidant plasma concentrations/levels. These researchers found that in those over 60 years old, low plasma levels of carotene, carotene and vitamin A, retinol, and vitamin E were related to specific subsequent cases of cancer - bronchus, stomach, all cancer and lung cancer respectively.

Several minerals have been indicated as playing a role in cancer. Schauzer, et al. (1977) and Clark (1985) have done research that implicates a relationship of low selenium intake to cancer in the colon and in the breast.

Various researchers have implicated iron for its role in cancer (Hollan and Johansen, 1993; Crawford, 1995; Herbert, et al., 1994; Stevens, et al., 1994; Lund and Aust, 1991; Ryan and Aust, 1992). These researcher acknowledge the benefit of iron in the diet but also discuss that iron, especially in high quantities, is positively associated with free radicals and the oxidative process. Herbert, et al.

(1994) points to the fact that due to iron's two fluctuating states in the body (ferrous and ferric), it can be a strong oxidant or reductant. Crawford (1995) discusses that citric acid and ascorbic acid compound the potential for iron overload (and therefore increased risk for cancer) due to their positive effect upon iron absorption and activities in the body.

Phytochemicals and Cancer: Machlin (1995) in his discussion of high intake of foods rich in antioxidants decreasing risk for some cancers, also discusses that there may be factors other than the antioxidants that these foods contain that may actually be the protective mechanism. As previously discussed, high intake of fruits and vegetables appears to decrease risk for cancer (Statland, 1992; Bjelke, 1975), and these foods are also high in phytochemicals.

Soybean components such as isoflavones diadzein and genistein have been researched for their possible roles in cancer prevention. Giri and Lu (1995) studied these components effects on gene materials, and in mice, diadzein and genistein had protective effects against cancer. Record, et al. (1995) found that genistein has antioxidant activities and that this may play a part in decreasing the risk for cancer.

Diabetes Mellitus

Due to the direct correlation of blood glucose and macronutrient intake in those with DM, there has been much study, discussion and controversies involving diet and DM control.

General Dietary Considerations and Diabetes Mellitus. It is currently generally accepted that the diabetic diet should be high in complex carbohydrates and low in fat. Several authors discuss the importance of a high carbohydrate diet (Vessby, 1994; Wursch, 1994; Otabe, et al., 1993; Irsy and Peterfai, 1991). There areindications that a diet that contains 55% (Vessby, 1994) to 60% (Irsy and Peterfai, 1991) of the calories as carbohydrates and that a high complex carbohydrate diet assists with energy balance as well as blood glucose control (Wursch, 1994). However, other authors indicate that a high carbohydrate diet may not be the most appropriate diet for those with DM (Riccardi and Rivellese, 1991; Hollenbeck and Coulston, 1991). Riccardi and Rivellese (1991) discuss that there is no true

evidence that a high carbohydrate (and low fat) diet is an advantage for controlling blood glucose and plasma lipid levels when compared to a high fat (mostly unsaturated) diet. Hollenbeck and Coulston (1991), from their review of literature, question the low fat/high carbohydrate diet's use in decreasing risk for CHD in those with DM.

Fiber and Diabetes Mellitus: Various research has discussed the positive effects of fiber for those with DM (Gray, 1995).

Sels, et al. (1991) discussed that dietary fiber generally has become regarded as a standard as an essential element for a healthy diet. However, Sels, et al. (1991) indicated that there are still many components that are unanswered regarding the use of a high fiber diet in controlling diabetes and the lipid metabolism as a result of diabetes.

Spiller (1994) offered the reason for soluble fibers positive effect on blood sugar by indicating soluble fibers delay gastric emptying and small bowel transit. This thereby slows down the absorptive process, assisting with better control of blood glucose levels. In contrast to other research, Nuttall (1993) indicated that a high fiber diet, especially soluble fiber, may not actually help control serum glucose levels. Nuttall (1993) indicated that in those studies showing control, there was usage of large amounts of fiber. There is further evidence that the fiber must be mixed with the administered food to help provide any glucose control.

Riccardi and Rivellese (1991) pointed out that fiber in the diet, especially in the form of soluble fiber, does help to decrease or control the adverse metabolic effects of a high carbohydrate diet. This translates to the statement that those with diabetes should consume adequate amounts of legumes, vegetables and fruits. Irsy and Peterfai (1991) also indicated that the use of high fiber in the diet is of a primary concern.

Minerals and Diabetes Mellitus: Sprietsma and Schuitemaker (1994) indicated that trace minerals have an important role in DM. These two authors indicated avoiding deficiencies of trace elements may assist with decreasing the incidence of the disease. Other authors discussed minerals more specifically.

Several studies indicate that zinc may have a role in DM. Walter, et al. (1991) and Williams, et al. (1995) both discussed that from their research zinc status is decreased in the population with DM. Williams, et al. (1995) indicated that zinc may play a role in diabetes due to its antioxidative properties. Faure, et al. (1992) furthered this thought by indicating that zinc deficiency could decrease the response to insulin, and that supplementing this mineral does appear to have a beneficial effect on blood glucose. However, Walter, et al. (1991) question whether diabetes affects the mineral status or whether the mineral status contributes to DM.

Magnesium has also been implicated as having a relationship with DM. Walter, et al. (1991) indicates that magnesium has a similar relationship to DM that zinc does. Magnesium status may be decreased in the population with DM. Ma, et al. (1995) concluded that low serum and dietary magnesium may be related to etiologies of DM. White and Campbell (1993) discussed a similar relationship between magnesium and DM, as well as a between hypomagnesemia and complications of DM. White and Campbell (1993) further discussed that supplementation of magnesium, for those with DM and documented hypomagnesemia, may be beneficial.

Another mineral that has been shown to have an association with DM is chromium. Pineau, et al. (1992) stated that chromium is known for its biological importance for normal glucose metabolism. Mossop (1991) discussed that trivalent chromium assists with improving glucose tolerance, and should therefore be considered in populations or individuals with DM that consume a diet high in refined grains rather than whole grains. Dubois and Belleville (1991) actually implicated chromium defiency as playing a role in the development of DM. However, Uusitupa, et al. (1992) studied elderly subjects with chronic blood glucose intolerance and found that chromium supplementation was not associated with an improvement in blood glucose levels.

Copper also has been discussed as having a disturbed metabolism in diabetic populations (Wallter, et al., 1991; Williams, et al, 1995). This disturbance in copper status is like other minerals in that it is not known whether the disturbance is a cause of or effect of DM..

Even such a lesser mentioned element as vanadium has been associated with diabetes. Mancinella (1993) and Brichard, et al. (1991) discussed that vanadium has insulin-like properties and may be instrumental in the treatment of DM.

Osteoporosis

Osteoporosis has many ramifications in the US. End results include higher health care cost (related to more hospitalizations due to bone breaks) and loss of independence and quality of life as people age (Volpe, et al., 1993). Prestwood, et al. (1995) and Volpe, et al. (1993) indicated osteoporosis is common and affects large numbers of women yearly. Licata (1994) indicated that 1 in 4 women over the age of 65 is affected by osteoporosis, and that intervention including nutrition, can slow down or halt the progression of osteoporosis, possibly even replacing some lost bone density.

A review of the National Institutes of Health Consensus Development Conference on Optimal Calcium Intake (1994) provided the following guidelines for calcium intake, to assist with osteoporosis prevention and decreasing progression of osteoporosis:

Adolescents/young adults - 1200-1500 mg/d
Postmenopausal women/estrogen replacement therapy - 1000 mg/d
Postmenopausal women/no estrogen replacement therapy - 1500 mg/d
All women/men over 65 years of age - 1500 mg/d

These recommended intakes are higher than the RDA.

General Dietary Considerations and Osteoporosis: Various general dietary considerations have been viewed in their relationship with osteoporosis. Kushi, et al. (1995) implicated high animal protein intake in the U.S., is likely to contribute to osteoporosis. Harris and Dawson-Hughes (1994) researched caffeine's effect upon bone density and bone loss in postmenopausal women. In this bone density study, the researchers found that bone density was not affected by caffeine intake in those women with adequate calcium intake. Among women who had lower calcium intake, higher intakes of caffeine was associated with more bone loss. Harris and Dawson-Hughes concluded that daily intake of caffeine at or above the recommended 300 mg/d concordantly with an inadequate calcium intake may result in accelerated bone loss even when compared to those women who have inadequate calcium intake but lesser caffeine intake.

Minerals, Vitamins and Osteoporosis: Although Albright, et al. (1941) discussed menopause and osteoporosis incidence, it has been documented that minerals have a large impact upon osteoporosis due

to nutrients' contributions to bone structure (Kral and Dawson-Hughes, 1994; Volpe, et al., 1993; Reginster, 1995). Phosphorus is a mineral that may compound the effects of other factors (i.e. high protein) for increasing risk of and morbidity of osteoporosis. Excessive phosphorus can result in bone mineral displacement, leading to or exacerbating osteoporosis (Krall and Dawson-Hughes, 1994).

Calcium and the combination of calcium and vitamin D, on the other hand, have had extensive research to try and identify optimal levels of intake to help prevent or decrease bone loss that occurs with aging. Authors on the subject of osteoporosis have indicated that calcium (Alexandre, 1995; Reginster, 1995; Palmieri, 1995 Ziegler, et al., 1995) and Vitamin D (Ziegler, et al., 1995; Reginster, 1995) are the two most important dietary components for this disease. Renner (1994) provided research, measuring bone mineral content of young adults and concluded that adequate calcium from milk/milk product in childhood and adolescence is of utmost importance for attaining peak bone deposition to help decrease risk for osteoporosis.

Reginster (1995), along with his discussion on calcium and vitamin D, indicated the importance of fluoride and bisphosphonates for treating this disease condition. Kanis (1993) discussed the long history (30 years) of fluoride treatment for osteoporosis and indicates that, despite this long history, use is still controversial.

Boron, magnesium, copper, manganese, zinc and vitamin K have all been implicated as having involvement with the etiology and/or progression of osteoporosis. Volpe, et al. (1993) indicated that supplementation with boron may have a very important role in preventing progression of osteoporosis by improving bone density. Wallach (1991) discussed the conflicting reports of magnesium's role in osteoporosis. Magnesium depletion may be causal and reports of increased bone density with magnesium supplementation do exist. Saltman and Strause (1993) discussed that various trace elements including copper, manganese and zinc are necessary for optimal bone matrix development and bone density.

Binkley and Suttie (1995) question vitamin K's role in osteoporosis. There is an association with low vitamin K levels in older people and those with osteoporotic fractures (Hodges, et al., 1991), but there is yet to be any proof that there is a causal effect or just an indication of nutritional status.

Overview of Nutrition and Health and Disease

There has been a mass of research, so immense, that this literature review could by no means review all the areas that have been researched. This review has provided information on some nutritional relationships with four of the ten leading causes of death (CVD, cancer, DM and osteoporosis) (US preventative Services Task Force, 1989; Willett, et al., 1995; Willett, 1994). There appears to be many single nutrients or various nutrient interactions that may play a role in decreasing or increasing disease risk. There also are still questions whether some of the relationships with nutrients are causal or effectal relationships, constituents of certain foods other than nutrients may be involved with disease prevention or control.

Studies in Eating Patterns and Intake

Various studies have examined eating patterns or methods of identifying eating behavior. Within these studies there have been specific statistical analyses run that are relevant to this project. This will be a review of literature regarding these subjects.

Grouping Techniques

In research of nutrition, frequently we may have large amounts of data and in order to better and more easily interpret data, data reduction may be appropriate. Grouping techniques are used for data reduction (Munroe and Page, 1993).

Factor analysis is one such statistical method, that helps a researcher to focus on large numbers of data at the same time by grouping variables into smaller groups or factors, allowing deciphering to be easier for large sets of data. It also may be used to help comprehend multiple factors affecting a single event. Once data has been run through factor analysis, it is reduced for later, more specific statistical analysis (Munroe and Page, 1993). Munroe and Page (1993) indicate that this method is the most appropriate method to review "a correlation matrix" and to allow for observing how the study variables group together.

Cluster analysis is another statistical grouping technique. Munroe and Page (1993) discuss that

cluster analysis is the appropriate method to "obtain empirical groups of subjects based on the subjects' values on selected variables". The authors indicate that this analysis methodology can help to identify homogeneous groups of subjects in a study. Cluster grouping technique results in groups whereby the individuals within each group are more homogeneous to each other than they are to individuals in other subsets (Munroe and Page, 1993).

Kristal, et al. (1990) developed a questionnaire to assess various areas of eating behavior which was designed based upon four hypothesized areas. In this research project, a "best model" was developed having 18 items with 5 factors. These factors related to dietary fat use patterns of exclusion, modification, substitution and replacement. Eating behavior that was directly relevant to the implementation of a low fat diet was appraiseds. Eating vehavior was determined and theory was developed to measure the selection of lower-fat foods into core and peripheral diets. In this study, Kristal, et al. (1990) used confirmatory factor analysis to help to identify 5 factors that agreed to the dimensions hypothesized with the exception of exclusion. The results of this study indicated a behavioral approach could be used to help estimate a dietary behavior or intake pattern.

Haines, et al. (1992) used cluster analysis to help to categorize women into eating patterns based upon where the food was consumed. The basis used was energy rather than specific meals. This research project used a classification of 8 possible places for consumption of foods:

at home	from home	restaurants
cafeterias	fast-food locations	vending machines
guest	other	

As cluster analysis is used to help categorize subjects into multiple dimensions, grouping subjects based upon their placement in a "multi-dimensional space," cluster analysis was used to analyze thes eating locations. Ten eating patterns were identified based upon the use of cluster analysis and were analyzed. This research project identified that energy, fat, saturated fat and cholesterol levels frequently were higher in those women who ate mostly away-from-home. These women also had lower intakes of calcium, dietary fiber, folacin and vitamin C. This type data indicates that demographics and location of eating should be considered when targeting intervention is thefocus.

Krebs-Smith, et al. (1990) did a study that examined differences in categorizing food mixtures

by 2 different methods. The 2 methods were 1) classifying food mixtures as single items, being classified by their major ingredient and 2) classifying food mixtures into their individual ingredients and assigned to the appropriate food group. The 2 classification systems were examined how each contributed to energy, protein, fat, saturated fatty acids, cholesterol carbohydrate and dietary fiber contents. Krebs-Smith, et al. (1990) found that the separation of food ingredients before assigning them to their food group did effect the contribution of those dietary components that were considered. When this was done, the meat group and grain group had less contributions to the 7 dietary components. On the contrary, milk products, fats and oils had a higher contribution to those dietary components, when the foods were broken down to their ingredients prior to being assigned into their food group. The researchers concluded that foods broken down into their constituent part from food mixtures had significant effects on nutrient data.

Kuczmarski, et al. (1986) conducted a project examining food choices based upon food groups. This data was then interpreted into dietary intake. Foods were categorized based upon fat and carbohydrate content (i.e. meats and dairy desserts were grouped according to type and percent fat; vegetables were group based upon dark green, legumes, etc.). All foods recorded on the 24-h recalls were allocated to the proper food group of which there were 14 major and 75 minor food groups. The groupings were not done by portion size but rather by a "yes-no tabulation". Food groups were found to affect contribution of some nutrient intakes. Three major food divisions contributed to 60% of the macronutrients. The meat group, dairy group and bread/cereal group contributed 81.2% of protein. The dairy group, bread/cereal group and sweets contributed 63% of carbohydrates. Lastly, the meat group, dairy group and fat foods group contributed 74.3% of fat. These researchers indicate that they classified food groups with macronutrients currently associated with health status (Kuczmarski, et al, 1986).

Randall, et al., (1989) conducted a study to address whether people who had variance in intake (of energy, fat, fiber, vitamins A and C) also differed in their dietary variety and differed in how food groups contributed to intake. They categorized foods into: "vegetables, fruits, meats, poultry and fish, dairy products and eggs, grains and nuts, nutrient non-dense foods, nutrient non-dense non-alcoholic beverages and nutrient non-dense alcoholic beverages". The researchers used a diet "diversity measure" which was based upon the advice to consume variety in the diet to better provide adequate nutrients.

The reported data was based upon servings and then represented as a percent of the intake recorded. The researchers indicated a difference existed between men and women regarding their intake of nutrients. Women consumed more vitamins A and C, while men had higher intakes of calories and macronutrients. There were indications that men and women had similar variety. Men consumed more variety from the meat, grain and nuts and alcohol groups, while women consumed more variety from the fruits, vegetables, and poultry and fish groups. Randall, et al. (1989) provided evidence that there is a need for better assessment patterns of eating to provide more precise associations with disease and diet.

Nicklas, et al., (1989) designed a study to examine eating patterns of adolescents as they "aged" and how this eating behavior was associated with risk factors. A food frequency questionnaire was designed to gather information about foods consumed. In this study, the researchers used factor analysis to distinguish eating patterns. Once factors were identified, the researchers then entered the data into statistical analysis. The factor analysis identified 17 "eating-pattern factors" that provided for 57% of the item variance. The researchers indicated that factor analysis was appropriate and useful to help in discerning eating patterns.

Nutrient Intake

Posner, et al. (1995) used data from the Framingham Study in 1957-1960, 1966-1969 and 1985-1988 to explore changes in dietary behavior and intake, and risk factors for CVD. The results indicated that the intake of dietary cholesterol declined over these time periods, but the intake of macronutrients and FAs changed only slightly. From 1966-1969 to 1984-1988, men increased their saturated fat intake (16.4% to 17.0%). Men and women both reported that they had a decreased intake of higher-fat animal products despite the steady macronutrient (including fat) intake.

Posner, et al. (1993) looked at data from the Framingham Offspring-Spouse population (1984-1988) and compared them to data from the 1976-1980 NHANES II and 1977-1978 USDA Nationwide Food consumption Surveys. Data indicated that total fat (36-41% of calories) and SFA (12.5-13.7% of calories) intakes were higher than the current recommendations and that carbohydrate intake (40-46% of calories) was lower. However, the Framingham women (but not men) decreased intake of dietary

cholesterol and sodium to a level that better aligns with the recommended intakes (Posner, et al., 1993).

Nicklas, et al. (1995) used data from the Bogalusa Study in Louisiana to look at the contribution of meat intake to overall quality of the diet and found that young adults consumed 6.5 ounces of meat on a daily basis. Meat intake affected nutrient intake. Those with higher meat intake consumed higher heme iron and phosphorus. Those with higher meat intake also had a higher percentage of subjects that met 67% of the RDA for the vitamins B12 and niacin as well as for the mineral zinc. Nicklas , et al. (1995) concluded that moderate amounts of lean meats and healthy choices in other food groups may be necessary to meet the current dietary recommendations.

A study conducted by the National Live Stock and Meat Board (NLSMB) (NLSMB, 1993) provided information regarding intake. The following provides an overview of total food group servings consumed for men and women.

Group	Total	Men	Women	FGP Guidelines
Grains	5.1	5.8	4.6	6-11
Vegetables	2.0	2.4	2.0	3-5
Fruits	1.0	1.0	1.0	2-4
Dairy	1.3	1.2	1.0	2-3
Meat	2.2	2.8	1.9	2-3
Other	3.5	4.1	3.2	Sparingly

An interesting finding from this research project was that men and women felt that they consumed close to the FGP's guidelines for servings from all food groups, when in reality their eating patterns were not. The table above provides information that indicates the population did not consume any food group within the FGP's guidelines for servings. Furthermore, only men consumed a food group (meat) within the FGP's guidelines for servings. The NLSMB study (NLSMB, 1993) also provided data on average daily intake for some nutritional components as follows.

	Total	Men	Women
Kilocalories/d	1657	1891	1447
Total Fat, g	67.4	78.1	58.4
SFA, g	24.1	27.6	20.6
MUFA, g	--	29.4	21.6
PUFA, g	--	14.9	11.6
Cholesterol, mg	257	305.5	225.3
Protein, g	67.5	79.2	58.8
Iron, mg	11.9	13.6	10.6
Zinc, mg	9.9	11.6	8.6
Carbohydrates, g	--	218.4	174.3
Sodium, mg	--	3469.6	2631.9

Thiamin, mg	1.29	--	--
Riboflavin, mg	1.64	--	--
Vitamin B6, mg	1.47	--	--
Vitamin B12, mcg	5.11	--	--

It is notable these subjects consumed a diet high in fat (36% for women, 37% for men, 37% for total).

There are several studies that discuss calcium intake. An Australian study by Portsmouth, et al. (1994) indicated that young women were at risk for osteoporosis due to self-imposed calorie reduced diets - the decreased calorie diets were inadequate in calcium. Fleming and Heimbach (1994) used data from the USDA 1987-88 Nationwide Food Consumption Survey. From their review of data, the mean daily intake for calcium was 737 mg. There was variance based upon region, income, ethnic group, sex and age, but for most groups, females had a significantly lower intake of calcium that the RDA. The National Institute (NIH) Consensus Development Conference on Optimal Calcium Intake (1994) indicated that there is still a large percentage of people in the US that do not meet the recommended guidelines for calcium intake.

Iron is a mineral that may be considered at risk for the elderly. However, Johnson, et al. (1994) discussed that non-institutionalized elderly people have reported intake of iron that meets the *RDA* for iron. However, elderly people may have practices that could decrease iron bioavailability and therefore iron stores in the body. These practices include low intakes of ascorbic acid or high intakes of calcium, and decreased consumption of highly available iron from meat, fish and poultry.

Overview of Studies in Eating Patterns and Intake

There have been numberous studies to try to identify methods to better assess qualitative and/or quantitative nutrient intake. Various populations (i.e. elderly, lower socioeconomic level groups) as well as the general population may not be consuming a diet that is parallel to the recommendations (i.e. $\leq$30% of calories from fat; higher fiber; more grains, vegetables and fruits; more calcium from dietary sources). Yet there are many studies that are trying to identify that(those) diet(s) which is(are) optimal.

CHAPTER III

METHODOLOGY

This chapter will present the methods and procedures used in this study. This chapter has been divided into 1) subjects, 2) anthropometries and biochemical markers, 3) instrumentation and procedures, and 4) data analysis.

Subjects

This study used food records previously provided by volunteers with no known debilitating or chronic diseases in the following 2 groups:

(1) Thirty-nine elderly subjects, 32 females and 7 males, solicited through newspaper advertisements and flyers posted on community bulletin boards. The subjects' mean age was 73 years of age. Two sets of 3-day food records were provided by this age-group. Biochemical markers via blood samples were evaluated from this group.

(2) Thirty young subjects, 20 females and 10 males, solicited through a Freshman nutrition course at Oklahoma State University. This age-group provided 1 set of 4-day food records. The subjects' mean age was 21 years of age. The project used self-reported dietary and anthropometric information from subjects.

The studies were approved by the Institutional Review Board at Oklahoma State University.

For the diet records, subjects were instructed verbally and in writing for as follows:

1. Record the kind and amount of food as you consumed it, do not delay in recording intake.
2. Include brand names, restaurant names, a thorough description of the food.
3. Include everything consumed, including condiments, beverages, water, gum, candy, salt added, water.
4. Eat as usual. Do not attempt to modify your diet.

Any dietary records that appeared to have obvious errors (i.e. missing days) or inconsistencies (some days recorded, others not) were not used.

Additional baseline data were also previously collected. For the young age-group, physical

measures related to health risk included weight, height, and desirable body weight. In the elderly age-group, biochemical markers (including triglycerides, total cholesterol, high-density cholesterol and blood glucose) were evaluated.

Anthropometries and Biochemical Markers

Anthropometric measures

For the young subjects, barefoot height, present body weight and subject's calculated desirable body weights were available. Ideal body weight was calculated for each young subject and was used as a basis for percent ideal body weight. Ideal body weight was based upon the following (Zeman, 1983):

Females: 100 pounds for 5 foot of height,
add 5 pounds for each
inch over 5 foot
NOTE: for any females under 5 foot in height, 2.5 pounds were taken off for each inch under 5 foot (i.e. 4'11" would be 97.5 pounds)

Males: 106 pounds for 5 foot of height,
add 6 pounds for each
inch over 5 foot

Body Mass Index was also calculated for each subject in this age group. Body Mass Index (BMI) is calculated as weight in kilograms divided by height in meter squared (kg/m2). The BMI is used as an index of obesity. Zeman and Ney (1988) indicates the following for guidelines for obesity:

Classification by
Body Mass Index

	Males	Females
Classification	BMI	BMI
Acceptable	<24	<24
Excess weight	24-25	24-27
Obesity	>27	>27

Blood Lipids Analysis

Blood measures were available for the elderly subjects. For these measures venous blood samples were taken to determine total plasma cholesterol, HDL cholesterol, plasma triglyceride and plasma glucose of the elderly subjects after a 12 hour fast. These were determined enzymatically, and

LDL-cholesterol was calculated as previously described (Hermann, et al., 1993).

Total serum cholesterol levels for the Elderly were compared to the National Cholesterol Education Program's classification scheme (NCEP, 1990) as follows:

	Total Cholesterol	Triglycerides
Desirable	<200 mg/dl	<250 mg/dl
Borderline high	200-239	>250
High	≥240	>500

HDL-cholesterol and total cholesterol:HDL-cholesterol ratio were compared to Wallach's Interpretation of Diagnostic Tests: A Synopsis of Laboratory Medicine (1992) as follows:

HDL-cholesterol	
Low risk (desirable level)	>60 mg/dl
Moderate risk	35-60 mg/dl
High risk	<35 mg/dl
Cholesterol:HDL ratio	
Low risk	3.3-4.4
Average risk	4.4-7.1
Moderate risk	7.1-11.0
High risk	>11.0

Instrumentation and Procedures

Dietary records were kept by each subject (elderly - 2 sets of 3-day records; young - 1 set of 4-day records). Subjects were instructed to record all foods and beverages immediately upon consumption and to record at least one weekend day and two week days (all to be consecutive days for each 3-day and 4-day dietary records).

The elderly subjects provided dietary records that did not identify meals and snacks, but these records were reviewed, and each record was classified into breakfast, lunch, and dinner as well as snacks (morning, afternoon and evening). Each record from the young subjects was also classified into breakfast, lunch, and dinner, but the snacks were listed as only one total because the dietary records only allowed a single section for all snacks to be recorded.

Diet records were reviewed to break down each subjects' intake into groups of foods based upon the general content of fat, fiber, and nutrients generally provided by that type food (i.e. vegetable with antioxidants - high in vitamins A and C). These groups were as follows:

1. Meat - red meats including pork and beef (including 1 record of venison) not prepared by adding fat;
2. Fattened meat - red meats prepared by adding fat;
3. Processed meats - included red and white meats that had been processed, except deli meats;
4. Fish - fin- and shell-fish not prepared by adding fat;
5. Fattened fish - fin- and shell-fish prepared by adding fat;
6. Poultry - turkey, chicken not prepared by adding fat;
7. Fattened poultry - poultry prepared by adding fat;
8. Eggs - eggs not prepared by adding fat;
9. Fattened eggs - any eggs prepared by adding fat;
10. Low-fat milks - milks 1% or less milkfat by weight;
11. High-fat milks - milks 2% or more milkfat by weight; if a type of milk was not described by the subject, then the milk was put into this category;
12. Cheese - cheeses (other than cottage cheese) or cheese sauces;
13. Cottage cheese - any cottage cheese;
14. High vitamin A and/or C fruits - fruits that provided 15% or more of the RDA for vitamins A and/or C;
15. Other fruits - fruits that do not provide a good source of vitamin A and/or C;
16. Dark green leafy or cruciferous vegetables - vegetables that are considered green leafy or cruciferous that could not be classified as high vitamin A and/or C;
17. Fattened dark green leafy or cruciferous vegetables - dark green leafy or cruciferous vegetables prepared by adding fat;
18. Beans - legumes not prepared by adding fat;
19. Fattened beans - legumes prepared by adding fat;
20. Potatoes - potatoes not prepared by adding fat;
21. Fattened potatoes - potatoes that were prepared by adding fat;
22. High vitamin A and/or C vegetables - vegetables that are good sources of vitamin A and/or C;

23. Fattened vitamin A and/or C vegetables - high vitamin A and/or C vegetables prepared by adding fat;

24. Other vegetables - vegetables that could not be categorized as green leafy/cruciferous, high vitamin A and/or C, or potatoes;

25. Fattened other vegetables - other vegetables prepared by adding fat;

26. Pastas and rices - pastas and rices not prepared by adding fat;

27. Fattened pastas and rices - pastas and rices prepared by adding fat;

28. Whole grain breads - breads, rolls and buns that were 100% whole grain; this had to be identified specifically on the dietary records in order for the bread to be classified under this category;

29. Fattened whole grain breads - whole grain breads, rolls and buns prepared by adding fat;

30. Breads - breads, rolls and buns that could not be classified as 100% whole grain; if subjects' wrote whole wheat bread and did not distinguish it as 100%, then the bread was classified as "bread";

31. Fattened breads - breads prepared by adding fat;

32. High fiber cereals - cereals providing 4 grams of fiber per serving or more;

33. Cereals - prepared or to-be-cooked cereals not prepared by adding fat;

34. Nuts and seeds;

35. Peanut butter (separate category from nuts and seeds related to most peanut butters having added hydrogenated oil and salt);

36. Pop/soda - non-alcoholic carbonated beverages sweetened with sugar;

37. Diet pop/soda - sugar-free, non-alcoholic carbonated beverages;

38. Candy - any candy, except hard candies (in sugar);

39. Coffee/tea;

40. Decaffeinated coffee/tea;

41. Alcoholic beverages - beer, wine, liquor, mixed drinks;

42. Animal fat - fats primarily of animal origins;

43. Vegetable fat - fats of vegetable origins;

44. Gravy/sauces - any form of gravy or sauces (only meat or fat based sauces were included in this category);

45. Higher-fat salad dressings - salad dressings that were not reduced fat;

46. Lower-fat salad dressings - any salad dressings that were reduced fat or non-fat;

47. Grain-type snacks - snacks or foods that were primarily a grain product;

48. Sweetened grain-type snacks - grain-type snacks that had sugar added;

49. Other snacks - other snack-type food that could not be classified into grain-type or sweetened grain-type snacks, or any other classification;

50. Cookies - any food product that was cookie-like, including bar cookies with fruit;

51. Cake

52. Fruit pies - pies made with fruit filling;

53. Other pies - pies made with other than fruit filling;

54. Dairy desserts - those desserts or sweets that are primarily a dairy product;

55. Lower-fat dairy desserts - dairy desserts that are "reduced" in fat;

56. Sweets other - those sweet, non-nutrient dense foods that could not be classified anywhere else;

57. Sugar - sugar added to drinks or any food, glazes, beverages that were not carbonated and primarily sugar, hard candies;

58. Sugar substitute - packets of sugar-substitute or non-carbonated beverages that were primarily sugar-substitute;

59. Condiments - any condiments used; these were primarily non-fat and salty "additive"; olives were the exception to non-fat;

60. Non-dairy creamers;

61. Jellos - if jellos had fruit or vegetables, these were further divided into the appropriate category;

62. Diet jellos - as with jellos.

If a food did not distinctly fit into a specific group, it would be broken down. For example, sandwiches were broken down into the identifiable ingredients that made that sandwich, or spaghetti with sauce was broken down into the appropriate vegetable, meat and pasta group.

Serving sizes were quantified by those serving sizes from the American Diabetic Association

Exchange diet and the Food Guide Pyramid (FGP) (USDA, 1992). These serving sizes were then "tallied" and placed into the respective food groups as identified above using the Excel 5.0 spreadsheet (Microsoft, 1995). These specific food groups defined above were then combined appropriately into the following more broadly defined groups:

1. Red meats - meat, fattened meat and processed meat;
2. White meats:
   a. White meat - fish, fattened fish, poultry and fattened poultry;
   b. Chicken - poultry and fattened poultry;
3. Eggs - eggs and fattened eggs;
4. Dairy - low-fat milk, high-fat milk, cheese and cottage cheese, dairy desserts and lower-fat dairy desserts;
5. Vegetables - high vitamin A and/or C vegetables, fattened high vitamin A and/or C vegetables, other vegetables, fattened other vegetables, dark-green leafy or cruciferous vegetables, fattened dark-green leafy or cruciferous vegetables, potatoes and fattened potatoes;
6. Fruit - high vitamin A and/or C fruits and other fruits;
7. Grains - pastas and rices, fattened pastas and rices, whole grain breads, fattened whole grain breads, breads, fattened breads, high fiber cereals, fattened high fiber cereals, cereals, fattened cereals and grain-type snacks;
8. Nuts and seeds - nuts and seeds, and peanut butter;
9. Beans - beans and fattened beans;
10. Other - candy, sweetened grain-type snacks, other snacks, cookies, cake, fruit pies, other pies, other sweets, sugar, sugar substitute, condiments, low-fat or non-fat salad dressings, non-dairy creamers, jellos and diet jellos:
11. Fats - animal fat, vegetable fat, gravy/sauces and higher-fat salad dressings.
12. Beverages - pop/soda, diet pop/soda, tea and coffee, decaffeinated tea and coffee; and
13. Alcohol - alcoholic beverages.

All nutrient information was analyzed using the dietary software program, Food Processor 6.04

(ESHA Research, 1994). The following dietary components were calculated by the Food Processor 6.0 program:

percent protein	percent carbohydrate	percent fat
percent alcohol	protein	total carbohydrates
complex carbohydrates	sugars	monosaccharides
disaccharides	total fat	saturated fat
monounsaturated fat	polyunsaturated fat	trans-fatty acids
omega-3 fatty acids	omega-6 fatty acids	cholesterol
dietary fiber	soluble fiber	insoluble fiber
total vitamin A	vitamin A, retinol	vitamin A, carotenoids
thiamin	riboflavin	niacin
niacin equivalents	vitamin B6	vitamin B12
biotin	folate	pantothenic acid
vitamin C	vitamin D	vitamin E
vitamin K	boron	calcium
chloride	chromium	copper
iodine	iron	magnesium
manganese	molybdenum	phosphorus
potassium	selenium	sodium
zinc	ethanol alcohol	caffeine
	water	

Data Analysis

All data were originally recorded into Microsoft Excel 5.0 (Microsoft, 1995) and then loaded onto the PC SAS using the Statistical Analysis System (Statistical Analysis System Institute, 1992) program for analysis of results. Descriptive statistics, including means and standard deviations, medians, minimums and maximums were calculated for all data, including physical measures, food categories and nutrient intakes.

To establish adequacy, two-thirds of the Recommended Dietary Allowance (RDA) (NRC-FNB, 1989) and Estimated Safe & Adequate Daily Dietary Intake Range (ESADDI) (NRC-FNB, 1989) for appropriate nutrients were used for the following corresponding age groups:

Males:	age group 19-24 year olds	age group 51+
Females:	age group 19-24 year olds	age group 51+

Two-thirds of the RDA/ESADDI was used due to the fact that this is a common criteria used to estimate adequacy of intake (Hermann, et al., 1992; Pao and Mickle, 1981; Kelsay, 1969).

When ranges were a part of the ESADDI, midpoints were used for comparison. Dietary fiber was based upon the midpoint value from The American Dietetics Association's (ADA, 1988)

recommended intake of 20-35 grams of fiber per day. The range is based upon different calorie intakes of an individual.

Mean intake of nutrients were compared to 100% of the RDA or ESADDI. Mean values of nutrient intake for individuals were further compared to two-thirds of the RDA, and percentages of those subjects meeting two-thirds of the RDA were calculated.

CHAPTER 4

RESULTS/DATA

Gender

Physical Measures

Tables 4.1 through 4.3 summarize the physical measures and associated regression equations for both age groups and are discussed within the section "Elderly Males versus Females" and Young Males versus Females".

Elderly Males versus Females

Physical measures available for the elderly subjects were total plasma cholesterol, HDL cholesterol, plasma triglyceride and plasma glucose (Table 4.1).

Although there were no differences in plasma cholesterol between the elderly males and elderly females, there was a difference in considered risk when values were compared to the NCEP's (NCEP, 1990) classification. Elderly males' mean serum cholesterol level of 198.43 is in the desirable range of less than 200 mg/dl, while elderly females' mean serum cholesterol level of 223.62 is in the borderline high range of 200-220 mg/dl. There were no differences in HDL-cholesterol levels between the elderly males and elderly females. Both elderly genders were in the moderate risk level based on HDL-cholesterol levels, according to Wallach's (1992) classification (35-60 mg/dl). However, the ratio of total cholesterol to HDL cholesterol for males and females were within Wallach's (1992) low risk range of 3.3-4.4 ratio.

Mean triglyceride levels for both elderly males and elderly females were within the desirable range of less than 250 mg/dl based upon the National Cholesterol Education Program's classification (NCEP, 1990). No differences were observed in triglyceride values between elderly males and elderly females (Table 4.1).

Fasting glucose levels were not different for elderly males or elderly females (Table 4.1), and

mean glucose values were well within the recommended range of 80-120 mg/dl.

Total cholesterol was the only physical measure for the elderly subjects that, when analysis was run, resulted in a regression equation that was statistically significant for predicting total cholesterol from food groups (Table 4.3). The vegetable and other group had a negative relationship with total cholesterol indicating that as intake of vegetable and other servings increased, there was an associated decrease in total cholesterol. These two food groups accounted for thirty-one percent (31%) of the variance for total cholesterol.

Young Males versus Females

Physical measures available for the young males and females were height and weight. Ideal body weight, percent ideal body weight and body mass index (BMI) were calculated (Table 4.2) Significant differences were observed in height, weight and ideal body weight between young males and young females as would be expected. Mean weights for both young males and females were well within the recommended percent ideal body weight of one-hundred percent plus or minus ten percent. Females had a BMI that was acceptable according to Zeman and Ney (1988), however, the males were slightly above acceptable. Young females had a significantly lower BMI than young males.

When analysis was run, a regression equation that was statistically significant for predicting physical measures from food groups resulted for the young subjects (Table 4.3). Red meat, other and white meat had a positive relationship with height, weight and ideal body weight, while fruit had a negative relationship with these three physical parameters. These four food groups accounted for 60%, 66% and 68% of the variance for each height, weight and ideal body weight, respectively. Nuts had a positive association with percent ideal body weight, while beans and fats had a negative relationship. These three food groups accounted for 31% of the variance for percent ideal body weight. Other and beverages both had a positive relationship with body mass index, and these two food groups accounted for 40% of the variance for body mass index.

Food Group Servings

Food group servings were tallied for elderly males, elderly females, young males and young

TABLE 4.1
PHYSICAL MEASURES OF ELDERLY ADULT MEN AND WOMEN

PHYSICAL MEASURES:	MALES:	FEMALES:	PROB (P<)	MEAN VALUES:
Number of subjects (n) =	7	32		
Total Cholesterol, mg/dl	198.43	223.62	0.14	211.02
HDL Cholesterol, mg/dl	53.01	52.32	0.88	52.67
Total Cholesterol:HDL Cholesterol	3.79	4.27	-	-
Triglycerides, mg/dl	192.60	173.32	0.57	182.96
Glucose, mg/dl	91.40	95.13	0.41	93.26

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.2
PHYSICAL MEASURES OF YOUNG ADULT MEN AND WOMEN

PHYSICAL MEASURES:	MALES:	FEMALES:	PROB (P<)	MEAN VALUES:
Number of subjects (n) =	10	20		
Height, centimeters	179.07	166.01	<0.01**	--
Weight, kilograms	77.95	58.61	<0.01**	--
Ideal Body Weight, kilograms	76.82	57.59	<0.01**	--
Percent Ideal body Weight(%)	101.60	102.20	0.87	101.90
Body Mass Index	24.32	21.33	<0.01**	22.82

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.3
REGRESSION EQUATIONS FOR PHYSICAL MEASURES

ELDERLY

	Coefficients	Prob>F
Total Cholesterol =		
Intercept	274.99	0.0001
Vegetables	-13.48	0.0200
Other	- 5.97	0.0015
Variables explained 31% of the variance		

YOUNG

Height =		
Intercept	63.80	0.0001
Red meat	3.36	0.0003
Fruit	- 1.25	0.0008
Other	0.24	0.0395
White Meat	1.30	0.0593
Variables explained 60% of the variance		
Weight =		
Intercept	111.30	0.0001
Other	3.04	0.0004
Red meat	20.61	0.0008
Fruit	- 5.69	0.0158
White meat	11.76	0.0136
Variables explained 66% of the variance		
Ideal body Weight =		
Intercept	111.65	0.0001
Red meat	25.17	0.0001
Fruit	- 7.41	0.0017
Other	2.15	0.0061
White meat	10.94	0.0161
Variables explained 68% of the variance		
Percent Ideal Body Weight =		
Intercept	105.79	0.0001
Nuts	12.56	0.0114
Beans	-10.74	0.0221
Fat	- 0.74	0.0379
Variables explained 31% of the variance		
Body Mass Index =		
Incercept	19.73	0.0001
Other	0.34	0.0007
Beverages	0.64	0.0393
Variables explained 40% of the variance		

females. Table 4.4 shows the mean servings by gender of the major food groups consumed. Males consumed significantly more servings of red meats, dairy, grains and other groups. There was also a trend for males to consume more vegetable servings. The overall intake of servings from these groups are compared to the Food Guide Pyramid's recommendations in the discussion below.

Tables 4.5-4.10 show the division of the major food groups into the specific food groups.

Table 4.5 presents the total mean servings for meats and meat equivalents; these values were 2.27 servings (6.81 ounces) for males versus 1.75 servings (5.25 ounces) for females. These totals are similar to the 4-6 ounce guidelines from the FGP. Although there was a statistically significant difference in the mean servings of fattened eggs between males and females, the total portions consumed were small.

Males consumed significantly more high-fat milks, cheeses and high-fat dairy desserts compared to the females (Table 4.6). When compared to the guidelines of 2-3 servings of milk/milk products from the Food Guide Pyramid, males were within this guideline while females were below. Considering the high sugar and high fat content of some of the dairy-type desserts along with low nutrient density, some of these items may be considered to be in the other food from the Food Guide Pyramid rather than the milk group.

Males consumed higher amounts (more servings) than females for fattened dark green, leafy vegetables as well as fattened potatoes (Table 4.7). The mean serving for fattened dark green, leafy vegetables was an inconsequential serving of 0.01. Fruit servings (1.95 males; 1.79 females) and vegetable servings (2.62 males; 2.07 females) consumed by both genders were lower than the FGP's guideline range of servings for fruits (2-4 servings) and vegetables (3-5 servings). These combined servings of fruits and vegetables also do not meet the American Dietetics Association's "five-a-day"campaign for fruits and vegetables..

The divisions of the grain group servings are summarized in Table 4.8. Males consumed significantly more bread than females. This bread group contributed more than any other group to total servings of the grain group. Both males and females consumed less than the guidelines of 6-11 servings of grains from the FGP (USDA, 1992). The males were especially low in grain servings related to their

TABLE 4.4
MEAN SERVINGS OF MAJOR FOOD GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Red meat	1.09	0.63	<0.01**
White meat	0.60	0.49	0.41
Eggs	0.12	0.10	0.78
Dairy	2.74	1.87	0.01**
Beans	0.32	0.29	0.81
Nuts	0.17	0.24	0.58
Fruits	1.94	1.79	0.72
Vegetables	2.62	2.08	0.06
Grains	5.54	4.40	0.02*
Fats	3.60	3.65	0.96
Beverages	1.82	1.62	0.60
Other	6.94	3.29	<0.01**
Alcohol	0.10	0.22	0.41

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.5
MEAN SERVINGS OF MEAT GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Meats	0.84	0.55	<0.01**
Meats, Fattened	0.06	0.02	0.09
Meats, Processed	0.20	0.06	<0.01**
Fish	0.04	0.09	0.27
Fish, Fattened	0.13	0.09	0.57
Poultry	0.38	0.22	0.15
Poultry, Fattened	0.05	0.09	0.49
Eggs	0.04	0.09	0.29
Eggs, Fattened	0.08	0.01	0.05*
Beans	0.01	0.26	0.98
Beans, Fattened	0.26	0.03	0.37
Nuts	0.07	0.06	0.84
Peanut Butter	0.11	0.18	0.45
TOTAL	**2.27**	**1.75**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.6
MEAN SERVINGS OF DAIRY GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Milk, low-fat	0.39	0.51	0.60
Milk, high-fat	0.71	0.36	0.03*
Cheeses/cheese sauce	0.84	0.50	0.02*
Cottage Cheese	0.04	0.18	0.09
Dairy desserts	0.48	0.21	0.05*
Dairy desserts, low-fat	0.28	0.10	0.12
TOTAL	**2.74**	**1.86**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.7
MEAN SERVINGS OF VEGETABLE AND FRUIT GROUPS BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Fruits, Vitamin A &/or C	1.14	1.18	0.88
Fruits, Other	0.81	0.61	0.40
Dark Green Leafy Vegetables	0.24	0.20	0.63
Dark Green Leafy Vegetables, Fattened	0.01	0.00	0.03*
Potatoes	0.43	0.29	0.14
Potatoes, Fattened	0.47	0.16	<0.01**
Vegetables, Vitamin A &/or C	0.59	0.54	0.58
Vegetables, Vitamin A &/or C Fattened	0.00	0.01	0.39
Vegetables, Other	0.82	0.84	0.92
Vegetables, Other Fattened	0.06	0.03	0.38
TOTAL	**4.57**	**3.86**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.8
MEAN SERVINGS OF GRAIN GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Breads, Whole-grain	0.05	0.17	0.41
Breads, Whole-grain Fattened	0.04	0.01	0.27
Breads	2.72	1.77	<0.01**
Breads, Fattened	0.51	0.66	0.48
Cereals, High-fiber	0.46	0.38	0.75
Cereals	0.89	0.50	0.11
Pastas/Rices	0.56	0.61	0.78
Pastas/Rices, Fattened	0.02	0.01	0.28
Grain-type Snacks	0.29	0.29	0.95
TOTAL	**5.54**	**4.40**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

mean calorie intake (2292 kcal/day).

No statistically significant differences were observed in servings consumed for the beverage groups (Table 4.9), however males tended to consume more soda than females. The totals of these groups contribute to the total "other" group from the FGP (USDA, 1992).

Males consumed more sugar, condiments and non-dairy creamers than females (Table 4.10). Males also tended to consume more fruit-type pies.

No differences were observed in fat groups servings (Table 4.11). However, when viewing total fat servings (Table 4.11) and considering total calories, percent fat and total fat, (Table 4.12), females consumed less of their fat calories from foods other than the fat groups. Males consumed more of their fat calories from food groups other than the fat groups.

Combining beverages, others and fats, males consumed 12.44 servings and females 8.79 servings.

Nutrient Intake

Tables 4.12-4.15 provide overviews of nutrient intakes. Tables 4.12-4.14 show the mean intake of nutrients per day, while Table 4.15 shows the daily mean intake of nutrient per 100 kilocalories.

Males had higher mean intake for the following: kilocalories, protein, carbohydrates, complex carbohydrates, sugars, disaccharides, total fat, saturated fat, monounsaturated fat, trans-fatty acids, cholesterol and water (Table 4.12). There was also a trend for males to consume higher amounts of monosaccharides. For vitamin intake (Table 4.13), males had a higher intake for: riboflavin, niacin, niacin-equivalents, vitamin B6, vitamin B12 and pantothenic acid. Table 4.14 shows that males consumed more boron, copper, iodine, iron, manganese, phosphorus, sodium and zinc.

Table 4.15 provides an overview of nutrient density by gender. Comparing Tables 4.12-4.14 with Table 4.15, many differences in nutrient intake were found based on energy intake rather than on differences in food selection. However, there was a trend for males to consume diets more nutrient dense in iodine and manganese than the diets of females.

Table 4.16 summarizes the percentage of those whose intake met 67% of the RDA or ESADDI. Significantly more male subjects consumed 67% or more of the RDA/ESADDI for iron and pantothenic

TABLE 4.9
MEAN SERVINGS OF BEVERAGE GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Pop/Soda	0.79	0.43	0.07
Pop/Soda, Diet	0.17	0.25	0.60
Coffee/Tea	0.71	0.78	0.81
Coffee/Tea, Decaffeinated	0.15	0.16	0.93
Alcoholic Beverage	0.10	0.22	0.41
TOTAL	**1.92**	**1.84**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.10
MEAN SERVINGS OF OTHER GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Candy	0.06	0.16	0.28
Salad-dressings, low/non-fat	0.02	0.05	0.57
Cookies	0.51	0.46	0.86
Cakes	0.07	0.15	0.21
Pies, Fruit	0.15	0.06	0.09
Pies, Other	0.02	0.01	0.12
Sweets, Other	0.00	0.01	0.47
Sugar	3.06	1.08	<0.01**
Sugar Substitute	0.19	0.28	0.66
Condiments	2.36	0.71	<0.01**
Sweetened Grain-type Snacks	0.21	0.21	0.98
Non-Dairy Creamers	0.27	0.03	<0.01**
Jellos	0.00	0.04	0.25
Diet Jellos	0.00	0.05	0.39
TOTAL	**6.92**	**3.30**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.11
MEAN SERVINGS OF FAT GROUPS
BY GENDER

FOOD GROUP:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Animal Fats	1.53	1.34	0.67
Vegetable Fats	1.07	0.69	0.20
Salad Dressings	0.78	1.35	0.43
Gravies/Sauces	0.22	0.27	0.77
TOTAL	**3.60**	**3.65**	

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.12
MEAN INTAKE OF NUTRIENTS
BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Kilocalories	2012	1479	<0.01**
Percent Protein	16	16	0.59
Percent Carbohydrates	51	51	0.79
Percent Fat	33	32	0.41
Percent Alcohol	<1	<1	0.21
Protein, g	76.69	59.47	<0.01**
Carbohydrates, g	262.12	193.84	<0.01**
Complex Carbohydrates, g	90.64	66.20	<0.01**
Sugars, g	119.71	88.24	0.01**
Monosaccharides, g	33.87	24.32	0.09
Disaccharides, g	31.20	21.47	0.02*
Total Fat, g	75.72	54.39	<0.01**
Saturated Fat, g	27.19	18.57	<0.01**
Monounsaturated Fat, g	28.05	19.45	<0.01**
Polyunsaturated Fat, g	12.69	10.43	0.07
Trans-fatty Acids, g	1.26	0.61	0.04*
Omega-3 Fatty Acids, g	0.86	0.74	0.21
Omega-6 Fatty Acids, g	8.21	26.24	0.67
Cholesterol, mg	241.01	149.37	<0.01**
Alcohol, g	1.06	2.20	0.46
Dietary Fiber, g	16.84	14.50	0.17
Soluble Fiber, g	3.84	3.46	0.49
Insoluble Fiber, g	7.16	7.67	0.71
Caffeine, mg	90.18	110.12	0.57
Water, cc	1772	1291	0.01**

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.13
MEAN INTAKE OF VITAMINS
BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Biotin, mcg	18.79	15.90	0.43
Folate, mcg	281.68	236.59	0.18
Niacin, mg	21.42	17.08	0.01**
Niacin-equivalents, mg	16.72	13.40	0.05*
Pantothenic Acid, mg	4.76	3.15	<0.01**
Riboflavin, mg	2.42	1.56	<0.01**
Thiamin, mg	1.62	1.34	0.23
Vitamin A, Carotenoids, RE	465.07	489.88	0.83
Vitamin A, Retinol, RE	732.11	471.74	0.27
Vitamin A, Total, RE	1289.55	1005.59	0.27
Vitamin B6, mg	1.80	1.36	<0.01**
Vitamin B12, mcg	8.90	3.73	0.03*
Vitamin C, mg	108.92	103.36	0.83
Vitamin D, mcg	4.34	3.60	0.28
Vitamin E, mg	6.95	5.88	0.34
Vitamin K, mcg	55.61	61.31	0.73

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.14
MEAN INTAKE OF MINERALS
BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Boron, mg	7.92	5.36	0.04*
Calcium, mg	927.58	746.98	0.15
Chloride, mg	635.11	536.55	0.28
Chromium, mcg	5.95	5.19	0.54
Copper, mg	1.25	0.99	0.03*
Iodine, mcg	250.66	80.54	0.03*
Iron, mg	15.38	12.11	0.03*
Magnesium, mg	163.93	226.85	0.13
Manganese, mg	6.60	2.54	<0.01**
Molybdenum, mcg	21.76	17.89	0.38
Phosphorus, mg	1300.41	1032.50	0.01**
Potassium, mg	2766.90	2302.85	0.07
Selenium, mcg	74.23	72.90	0.93
Sodium, mg	2935.98	2271.20	<0.01**
Zinc, mg	10.78	8.02	<0.01**

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.15
MEAN INTAKE OF NUTRIENTS PER 100 KILOCALORIES BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Kilocalories	2012	1479	<0.01**
Protein	3.88	4.06	0.44
Fiber	0.87	1.00	0.19
Folate	14.13	16.36	0.26
Niacin	1.10	1.16	0.45
Riboflavin	0.12	0.11	0.39
Thiamin	0.08	0.09	0.55
Vitamin A	65.11	69.42	0.74
Vitamin B6	0.09	0.09	0.77
Vitamin B12	0.42	0.25	0.11
Vitamin C	2.89	4.32	0.20
Vitamin D	0.22	0.24	0.52
Vitamin E	0.36	0.39	0.61
Vitamin K	0.03	0.04	0.50

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.15 (cont'd.)
MEAN INTAKE OF NUTRIENTS PER 100 KILOCALORIES BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Biotin	0.93	1.06	0.53
Calcium	45.97	49.71	0.53
Chloride	29.86	36.48	0.18
Chromium	0.32	0.36	0.55
Copper	0.06	0.07	0.34
Iodine	10.72	5.26	0.10
Iron	0.79	0.83	0.67
Magnesium	13.43	15.45	0.12
Manganese	0.30	0.18	0.07
Molybdenum	1.10	1.24	0.63
Pantothenic Acid	0.23	0.22	0.42
Phosphorus	64.74	69.82	0.28
Potassium	139.78	157.49	0.16
Selenium	3.74	4.87	0.25
Sodium	150.37	155.48	0.68
Zinc	0.54	0.55	0.84

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.16
PERCENT OF THOSE WHOSE INTAKE MET 67% OF RDA/ESAI BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Kilocalories	81	69	0.31
Protein	100	98	0.47
Fiber	34	13	0.06
Folate	95	80	0.08
Niacin	100	88	0.11
Riboflavin	95	95	1.00
Thiamin	95	90	0.49
Vitamin A	73	72	0.93
Vitamin B6	71	73	0.86
Vitamin B12	100	90	0.12
Vitamin C	90	80	0.27
Vitamin D	51	33	0.18
Vitamin E	44	49	0.67
Vitamin K	26	46	0.12

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.16 (cont'd)
PERCENT OF THOSE WHOSE INTAKE MET 67% OF RDA/ESAI BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Biotin	14	5	0.19
Calcium	71	55	0.19
Chloride	44	46	0.89
Chromium	0	0	--
Copper	24	10	0.17
Iodine	46	22	0.06
Iron	100	73	<0.01**
Magnesium	68	65	0.83
Manganese	66	45	0.14
Molybdenum	0	0	--
Pantothenic Acid	61	28	0.01**
Phosphorus	95	83	0.13
Potassium	95	83	0.13
Selenium	85	88	0.77
Sodium	100	100	--
Zinc	61	39	0.11

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

acid than did female subjects. Males also tended to consume higher concentrations of fiber, folate and iodine.

Table 4.17 shows the ratio of the daily mean intake to 100% of the RDA/ESADDI. A gender value of 1.00 indicates that the group met the RDA/ESADDI for that nutrient. A value lower than one indicated the gender did not meet the RDA. A value greater than one showed the gender consumed more than the RDA. Males had a significantly higher ratio for vitamin B12, phosphorus, iron, iodine, pantothenic acid, copper, manganese and sodium. There was also a trend for males to have higher adequacy for potassium. Those nutrients that both genders consumed $\leq$67% of the RDA/ESADDI included fiber, vitamin D, biotin, copper, molybdenum and chromium. The values for copper, molybdenum and chromium may be lower because many foods have not been analyzed for these components.

Summary for Gender

Males frequently consumed more servings in many food groups than females. Based upon the FGP's guidelines, females consumed inadequate servings of dairy, vegetables, fruit and grains. Males, on the other hand, consumed inadequate servings of vegetables and grains. While males usually consumed higher levels of various nutrients, they did not consume a more nutrient dense diet, but rather the higher nutrient intake was related to higher total energy consumed (Table 4.15).

Age

Food Group Servings

Table 4.18 and Tables 4.19 - 4.25 provide information on mean daily intake of the general and specific food groups for each age group.

Young subjects consumed more servings of red meat, while elderly subjects consumed more servings of nuts, fruits and vegetables (Table 4.18).

Young subjects consumed higher portions for meats and fattened eggs, while elderly consumed more portions of beans, fattened beans and nuts (Table 4.19). However, the portions both for fattened

TABLE 4.17
RATIO OF MEAN INTAKE TO "RECOMMENDED"
(BY RDA/ESAI)
BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Kilocalories	0.77	0.73	0.26
Protein	1.28	1.24	0.66
Fiber	0.56	0.48	0.17
Folate	1.41	1.31	0.61
Niacin	1.26	1.23	0.79
Riboflavin	1.55	1.26	0.08
Thiamin	1.21	1.29	0.72
Vitamin A	1.29	1.26	0.91
Vitamin B6	0.90	0.85	0.54
Vitamin B12	4.45	1.86	0.03*
Vitamin C	1.82	1.72	0.83
Vitamin D	0.64	0.57	0.53
Vitamin E	0.69	0.73	0.76
Vitamin K	0.72	0.97	0.32

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.17 (cont'd.)
RATIO OF MEAN INTAKE TO "RECOMMENDED"
(BY RDA/ESAI)
BY GENDER

NUTRIENT:	MALES:	FEMALES:	PROB (P<):
Number of subjects (n) =	17	52	
Biotin	0.29	0.24	0.43
Calcium	0.95	0.80	0.31
Chloride	0.85	0.72	0.28
Chromium	0.05	0.04	0.54
Copper	0.56	0.44	0.03
Iodine	1.67	0.54	0.03*
Iron	1.54	1.02	<0.01**
Magnesium	0.75	0.81	0.50
Manganese	1.89	0.73	<0.01**
Molybdenum	0.13	0.11	0.38
Pantothenic Acid	0.86	0.57	<0.01**
Phosphorus	1.34	1.10	0.03*
Potassium	1.38	1.15	0.07
Selenium	1.06	1.33	0.35
Sodium	5.87	4.54	<0.01**
Zinc	0.72	0.67	0.46

*Males and females significantly different at $p < 0.05$
**Males and females significantly different at $p < 0.01$

TABLE 4.18
MEAN SERVINGS OF MAJOR FOOD GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Red meat	0.72	1.01	0.01**
White meat	0.45	0.64	0.16
Eggs	0.12	0.10	0.82
Dairy	2.36	2.25	0.73
Beans	0.38	0.22	0.19
Nuts	0.32	0.09	0.04*
Fruits	2.47	1.27	<0.01**
Vegetables	2.75	1.95	<0.01**
Grains	4.65	5.29	0.19
Fats	3.35	3.89	0.60
Beverages	1.71	1.73	0.96
Other	4.80	5.43	0.48
Alcohol	0.07	0.26	0.18

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.19
MEAN SERVINGS OF MEAT GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Meats	0.56	0.82	0.02*
Meats, Fattened	0.03	0.04	0.61
Meats, Processed	0.12	0.14	0.68
Fish	0.07	0.06	0.72
Fish, Fattened	0.05	0.18	0.07
Poultry	0.29	0.31	0.78
Poultry, Fattened	0.05	0.09	0.31
Eggs	0.11	0.02	0.07
Eggs, Fattened	0.01	0.08	0.04*
Beans	0.01	0.00	0.05*
Beans, Fattened	0.38	0.14	0.02*
Nuts	0.12	0.00	0.03*
Peanut Butter	0.20	0.09	0.26
TOTAL	**2.00**	**1.97**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

eggs and for beans were very small.

For the dairy groups (Table 4.20), young subjects consumed more cheeses, while elderly consumed more low-fat dairy desserts. Both groups consumed the FGP's guideline servings of 2 to 3 dairy foods per day, but it should be considered that the 2 dairy groups - dairy desserts and low-fat dairy desserts - contributed a relatively high amount to those total dairy servings. As previously mentioned, some nutrition professionals may consider dairy desserts, and possibly low-fat dairy desserts, as other due to low nutrient density and higher sugar content. Both elderly females and those females under 25 years of age may benefit from 3 servings of dairy per day to help contribute towards the recommended 1200-1500 mg of calcium per day (NIH, 1994). Neither sets of females consumed dairy products or calcium sources at this level.

Elderly subjects consumed more vegetables and fruit (Table 4.21). Elderly subjects consumed more servings of: vitamin A and/or C fruits; dark green, leafy vegetables, both plain and fattened; potatoes; and vitamin A and/or C vegetables; other vegetables and other fattened vegetables. Total fruit and vegetable servings for the elderly met the recommendation of at least "five-a-day", yet neither elderly nor young consumed 3 servings of vegetables per day. Some of the vegetables chosen (such as french fries) were in a high fat, high salt form that may be considered as other in the FGP.

Young subjects consumed more servings of pastas/rices and grain-type snacks (Table 4.22). Elderly consumed more servings of fattened, whole-grain breads but this difference is an insignificant part of the total diet as the portion was so small. Intake of whole grains was very small in both groups. Neither age group consumed the minimum guidelines of 6 or more servings from the grain group per day.

The consumption of beverages also differed between these groups. The young consumed more pop/soda than the elderly, while elderly consumed more coffee/tea, both caffeinated and decaffeinated (Table 4.23).

Although other-type pies (non-fruit pies) and non-dairy creamers were consumed in higher portions by the elderly compared to the young, both were very small amounts (Table 4.24). Table 4.25 presents the mean servings of the fat groups. Young subjects consumed more servings of animal fat while elderly subjects consumed more servings of vegetable fat. The young subjects also tended to

TABLE 4.20
MEAN SERVINGS OF DAIRY GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Milk, low-fat	0.67	0.24	0.06
Milk, high-fat	0.39	0.68	0.06
Cheeses/cheese sauce	0.35	0.98	<0.01**
Cottage Cheese	0.17	0.05	0.15
Dairy desserts	0.43	0.26	0.21
Dairy desserts, low-fat	0.35	0.04	<0.01**
TOTAL	**2.36**	**2.25**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.21
MEAN SERVINGS OF VEGETABLE AND FRUIT GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Fruits, Vitamin A &/or C	1.58	0.74	0.01**
Fruits, Other	0.89	0.53	0.12
Dark Green Leafy Vegetables	0.31	0.14	0.05*
Dark Green Leafy Vegetables, Fattened	0.01	0	0.03*
Potatoes	0.47	0.26	0.03*
Potatoes, Fattened	0.14	0.49	<0.01**
Vegetables, Vitamin A &/or C	0.71	0.42	<0.01**
Vegetables, Vitamin A &/or C Fattened	0.01	0	0.39
Vegetables, Other	1.01	0.65	0.03*
Vegetables, Other Fattened	0.09	0.00	<0.01**
TOTAL	**5.22**	**3.23**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.22
MEAN SERVINGS OF GRAIN GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Breads, Whole-grain	0.18	0.04	0.34
Breads, Whole-grain Fattened	0.05	0	0.02*
Breads	1.98	2.52	0.06
Breads, Fattened	0.59	0.58	0.94
Cereals, High-fiber	0.56	0.28	0.26
Cereals	0.79	0.61	0.44
Pastas/Rices	0.40	0.77	0.03*
Pastas/Rices, Fattened	0.01	0.01	0.96
Grain-type Snacks	0.09	0.49	<0.01**
TOTAL	**4.65**	**5.30**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.23
MEAN SERVINGS OF BEVERAGE GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Pop/Soda	0.10	1.12	<0.01**
Pop/Soda, Diet	0.08	0.34	0.07
Coffee/Tea	1.22	0.27	<0.01**
Coffee/Tea, Decaffeinated	0.31	0.00	0.01**
Alcoholic Beverage	0.07	0.26	0.18
TOTAL	**1.78**	**1.99**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.24
MEAN SERVINGS OF OTHER GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Candy	0.08	0.14	0.49
Salad-dressings, low/non-fat	0.07	0.00	0.11
Cookies	0.47	0.50	0.90
Cakes	0.11	0.11	0.90
Pies, Fruit	0.13	0.08	0.31
Pies, Other	0.03	0.00	0.01**
Sweets, Other	0.00	0.01	0.47
Sugar	1.89	2.25	0.59
Sugar Substitute	0.31	0.17	0.52
Condiments	1.26	1.81	0.33
Sweetened Grain-type Snacks	0.09	0.33	0.11
Non-Dairy Creamers	0.31	0.00	<0.01**
Jello	0.04	0.00	0.25
Diet Jello	0.00	0.05	0.44
TOTAL	**4.79**	**5.45**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.25
MEAN SERVINGS OF FAT GROUPS
BY AGE

FOOD GROUP:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Animal Fats	0.97	1.90	0.04*
Vegetable Fats	1.19	0.57	0.04*
Salad Dressings	0.82	1.31	0.50
Gravies/Sauces	0.38	1.11	0.09
TOTAL	**3.36**	**4.89**	

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

consume more servings of gravies/sauces.

Nutrient Intake

Table 4.26 presents intake of macronutrients and other food components by the elderly and young subjects. Several trends and statistically significant differences were found.

Young subjects consumed more kilocalories, total fat, saturated fat, monounsaturated fat and cholesterol than older subjects. There was a trend for the young to also consume a higher percentage of calories as fat, more complex carbohydrates and more monosaccharides. Elderly subjects consumed more soluble and insoluble fiber despite the lower calorie intake. (They also tended to consume a higher percentage of calories as carbohydrates). For percentages of calories from protein, carbohydrates and fat, both age groups were similar to the recommended 15% protein, 55% carbohydrates and $\leq$30% fat, with the young subjects low in carbohydrates.

Table 4.27 shows that elderly subjects consumed more carotenoids, biotin, vitamin E and vitamin K. There also was a trend for the young subjects to consume more vitamin B12.

Table 4.28 shows that the elderly consumed more boron, chromium, magnesium, molybdenum and potassium. Young subjects consumed more sodium, and there was a trend for the young to consume more iodine and manganese.

Table 4.29 presents mean intakes of nutrients per 100 kilocalories. Elderly consumed a diet more nutrient dense for fiber, vitamins B6, C, E, C, biotin, folate, pantothenic acid, and minerals chromium, copper, magnesium, molybdenum, phosphorus and potassium. There were also trends for higher intake by the elderly (based on a per kilocalorie basis) for protein, fiber, vitamin D and iron. Table 4.29 provides important information about nutrient intake. It appears that the statistically significant differences in actual intake of the nutrient between the young and elderly groups is generally calorically driven - even though the elderly ate fewer calories, the nutrient density of those calories consumed was higher.

Table 4.30 provides information on the percentages of those subjects, for each age group, that met at least 67% or more of the RDA/ESADDI. The elderly subjects chose a generally more nutrient dense diet and also had a significantly higher percentage of subjects that attained this 67% standard for

TABLE 4.26
MEAN INTAKE OF MACRO-NUTRIENTS
BY AGE

NUTRIENT COMPONENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Kilocalories	1603	1888	<0.01**
Percent Protein	16	15	031
Percent Carbohydrates	53	49	0.08
Percent Fat	31	34	0.08
Percent Alcohol	<1	<1	0.23
Protein, g	66.38	69.77	0.46
Carbohydrates, g	217.87	238.09	0.18
Complex Carbohydrates, g	73.41	83.43	0.08
Sugars, g	98.75	109.20	0.39
Monosaccharides, g	24.15	34.04	0.08
Disaccharides, g	26.47	26.21	0.95
Total Fat, g	56.90	73.21	<0.01**
Saturated Fat, g	19.04	26.71	<0.01**
Monounsaturated Fat, g	21.29	26.20	0.02*
Polyunsaturated Fat, g	11.36	11.76	0.74
Trans-fatty Acids, g	1.04	0.84	0.51
Omega-3 Fatty Acids, g	0.81	0.79	0.81
Omega-6 Fatty Acids, g	27.15	7.29	0.64
Cholesterol, mg	162.30	228.07	<0.01**
Alcohol, g	0.41	2.85	0.12
Dietary Fiber, g	18.96	12.38	<0.01**
Soluble Fiber, g	5.15	2.15	<0.01**
Insoluble Fiber, g	9.51	5.32	<0.01**
Caffeine, mg	129.31	70.93	0.10
Water, cc	1476	1587	0.54

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.27
MEAN INTAKE OF VITAMINS
BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Biotin, mcg	23.41	11.29	<0.01**
Folate, mcg	289.80	228.47	0.07
Niacin, mg	18.36	20.13	0.29
Niacin-equivalents, mg	15.06	15.06	1.00
Pantothenic Acid, mg	4.00	3.90	0.83
Riboflavin, mg	1.83	2.15	0.20
Thiamin, mg	1.61	1.35	0.27
Vitamin A, Carotenoids, IU	764.26	190.69	<0.01**
Vitamin A, Retinol, IU	531.41	672.44	0.55
Vitamin A, Total, IU	1331.04	964.10	0.15
Vitamin B6, mg	1.64	1.53	0.44
Vitamin B12, mcg	4.11	8.51	0.06
Vitamin C, mg	123.74	88.54	0.17
Vitamin D, mcg	4.12	3.83	0.67
Vitamin E, mg	7.89	4.93	<0.01**
Vitamin K, mcg	86.46	30.45	<0.01**

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.28
MEAN INTAKE OF MINERALS
BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Boron, mg	8.68	4.59	<0.01**
Calcium, mg	843.84	830.71	0.92
Chloride, mg	575.10	596.56	0.81
Chromium, mcg	7.78	3.36	<0.01**
Copper, mg	1.14	1.10	0.74
Iodine, mcg	97.97	233.24	0.09
Iron, mg	14.03	13.46	0.70
Magnesium, mg	279.43	211.35	<0.01**
Manganese, mg	3.12	6.02	0.06
Molybdenum, mcg	24.68	14.97	0.03*
Phosphorus, mg	1178.24	1154.68	0.82
Potassium, mg	2941.34	2128.41	<0.01**
Selenium, mcg	64.39	82.74	0.25
Sodium, mg	2342.53	2864.65	0.01**
Zinc, mg	9.17	9.63	0.59

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.29
MEAN INTAKE OF NUTRIENTS PER 100 KILOCALORIES BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	17	52	
Protein, g	4.17	4.06	0.08
Fiber, g	1.18	1.00	<0.01**
Folate, mcg	18.33	16.36	<0.01**
Niacin, mg	1.17	1.16	0.41
Riboflavin, mg	0.12	0.11	0.58
Thiamin, mg	0.10	0.09	0.05*
Vitamin A, RE	83.37	69.42	0.02*
Vitamin B6, mg	0.10	0.09	<0.01**
Vitamin B12, mcg	0.26	0.25	0.15
Vitamin C, mg	5.35	4.32	<0.01**
Vitamin D, mcg	0.26	0.24	0.08
Vitamin E, mg	0.49	0.39	<0.01**
Vitamin K, mcg	0.05	0.02	<0.01**

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.29 (cont'd.)
MEAN INTAKE OF NUTRIENTS PER 100 KILOCALORIES BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	17	52	
Biotin, mcg	1.42	0.58	<0.01**
Calcium, mg	52.00	43.69	0.17
Chloride, mg	36.31	29.93	0.19
Chromium, mcg	0.49	0.19	<0.01**
Copper, mg	0.07	0.06	0.03*
Iodine, mcg	6.10	9.88	0.25
Iron, mg	0.89	0.73	0.07
Magnesium, mg	17.49	11.39	<0.01**
Manganese, mg	0.20	0.28	0.20
Molybdenum, mcg	1.53	0.82	0.02*
Pantothenic Acid, mg	0.25	0.20	0.01**
Phosphorus, mg	73.36	61.20	0.01**
Potassium, mg	183.05	114.22	<0.01**
Selenium, mcg	4.08	4.53	0.65
Sodium, mg	147.25	158.60	0.35
Zinc, mg	0.58	0.51	0.15

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.30
PERCENT OF THOSE WHOSE MEAN INTAKE MET 67% OF THE RDA/ESAI BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Kilocalories	79	70	0.42
Protein	100	98	0.47
Fiber	40	8	<0.01**
Folate	100	75	<0.01**
Niacin	98	90	0.25
Riboflavin	100	90	0.09
Thiamin	100	85	<0.01**
Vitamin A	90	55	<0.01**
Vitamin B6	81	63	0.12
Vitamin B12	100	90	0.12
Vitamin C	100	70	<0.01**
Vitamin D	64	20	<0.01**
Vitamin E	63	30	0.02*
Vitamin K	57	15	<0.01**

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.30 (cont'd.)
PERCENT OF THOSE WHOSE MEAN INTAKE MET 67% OF THE RDA/ESAI BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Biotin	19	0	0.01**
Calcium	78	48	0.01**
Chloride	46	45	0.97
Chromium	0	0	--
Copper	22	13	0.35
Iodine	39	30	0.51
Iron	98	75	<0.01**
Magnesium	88	45	<0.01**
Manganese	69	43	0.06
Molybdenum	0	0	--
Pantothenic Acid	61	28	0.01**
Phosphorus	100	78	<0.01**
Potassium	100	78	<0.01**
Selenium	100	73	<0.01**
Sodium	100	100	--
Zinc	48	53	0.74

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

the following: fiber, vitamins A ,C, D, E, biotin, folate, pantothenic acid and thiamin, and minerals calcium, iron, magnesium, phosphorus, potassium and selenium. The elderly also tended to have more subjects that consumed at least 67% of the RDA/ESADDI for riboflavin and manganese. It should be considered that missing values for biotin, copper, molybdenum and chromium may affect analyses for differences for each age group.

The mean intake per day of nutrients compared to the RDA/ESADDI is presented in Table 4.31. Elderly had levels that were statistically higher for: fiber, vitamins D, E, K, biotin and thiamin, and minerals calcium, chromium, magnesium, phosphorus, and molybdenum, with a trend for higher adequacy for folate. Young subjects had higher adequacy for sodium, and there was a trend for higher adequacy for vitamin B12.

Summary for Age

Comparing the patterns of selections of foods based upon the FGP's guidelines, elderly consumed inadequate amounts of vegetables and grains. The young subjects had intakes below the FGP's guidelines for daily servings of fruits, vegetables and grains.

With the exceptions of kilocalories, fats (total, saturated, monounsaturated) and sodium, elderly generally consumed higher levels of fiber components, vitamins A (carotenoids), E, K and biotin, and minerals chromium, magnesium, molybdenum and potassium. Table 4.29 provides information on the nutrient density of the diets for elderly and young; the elderly selected more nutrient dense items.

Age-Gender Interaction

Food Group Servings

Tables 4.32 through 4.39 presents the food groups consumed based on age and gender interaction.

Table 4.32 shows that the only food group that was consumed differently among the age/gender groups was the red meats group. Young males consumed more red meats than any of the other three age-gender groups. There was a trend for young males to consume more of the other group than young

TABLE 4.31
RATIO OF MEAN INTAKE TO "RECOMMENDED"
(BY RDA/ESAI)
BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Kilocalories	0.76	0.73	0.44
Protein	1.19	1.33	0.12
Fiber	0.63	0.41	<0.01**
Folate	1.53	1.19	0.07
Niacin	1.32	1.17	0.20
Riboflavin	1.41	1.39	0.93
Thiamin	1.48	1.03	0.05*
Vitamin A	1.50	1.04	0.11
Vitamin B6	0.92	0.83	0.32
Vitamin B12	2.06	4.26	0.06
Vitamin C	2.06	1.48	0.17
Vitamin D	0.82	0.38	<0.01**
Vitamin E	0.88	0.55	0.01**
Vitamin K	1.20	0.48	<0.01**

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.31 (cont'd.)
RATIO OF MEAN INTAKE TO "RECOMMENDED"
(BY RDA/ESAI)
BY AGE

NUTRIENT:	ELDERLY:	YOUNG:	PROB (P<):
Number of subjects (n) =	39	30	
Biotin	0.36	0.17	<0.01**
Calcium	1.05	0.69	0.02*
Chloride	0.77	0.80	0.81
Chromium	0.06	0.03	<0.01**
Copper	0.51	0.49	0.74
Iodine	0.65	1.55	0.09
Iron	1.40	1.16	0.07
Magnesium	0.89	0.67	<0.01**
Manganese	0.89	1.72	0.06
Molybdenum	0.15	0.09	0.03*
Pantothenic Acid	0.73	0.71	0.83
Phosphorus	1.47	0.96	<0.01**
Potassium	1.47	1.06	<0.01**
Selenium	1.04	1.35	0.28
Sodium	4.69	5.73	0.01**
Zinc	0.68	0.70	0.79

*Elderly and Young significantly different at $p < 0.05$
**Elderly and Young significantly different at $p < 0.01$

TABLE 4.32
MEAN SERVINGS OF MAJOR FOOD GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Red meat	0.77b	0.66b	1.42a	0.59b	0.12	<0.01**
White meat	0.42	0.48	0.79	0.50	0.14	0.21
Eggs	0.08	0.15	0.16	0.05	0.06	0.13
Dairy	2.62	2.10	2.86	1.63	0.33	0.28
Nuts	0.35	0.29	0.00	0.18	0.11	0.73
Fruits	2.47	2.47	1.42	1.12	0.42	0.65
Vegetables	2.96	2.54	2.29	1.61	0.29	0.85
Grains	5.18	4.13	5.90	4.68	0.48	0.89
Fats	3.26	3.45	3.94	3.85	1.04	0.32
Beverages	1.71	1.71	1.92	1.54	0.37	0.61
Beans	0.42	0.34	0.21	0.23	0.12	0.70
Other	5.85	3.75	8.04	2.83	0.90	0.09
Alcohol	0.00	0.13	0.21	0.32	0.15	0.95

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

females and elderly females, and for elderly males to consume more of the other group than young females.

Young males consumed more servings of meats and fattened eggs than the other age-gender groups (Table 4.33).

No differences in dairy groups servings for any age-gender group were observed at $P<0.05$ (Table 4.34). However, young males tended to consume more high fat milk. Young females consumed the least servings of dairy (only 1.63 servings). Both elderly and young females consumed less than the 3 servings of dairy that support bone density.

Elderly males consumed more portions of fattened dark green, leafy vegetables (Table 4.35), however intakes were very small. Elderly males and elderly females consumed at least 2 servings of fruits, meeting the FGP's guidelines for minimum servings for fruits, while neither young males nor young females consumed at least 2 servings of fruit. No age-gender group consumed at least the FGP's guidelines of 3 servings of vegetables. Young females consumed the lowest amounts of fruits and vegetables.

Young males consumed more servings of bread than elderly males, elderly females or young females (Table 4.36). There was a trend for young females to consume more pastas/rices than elderly females. No age-gender group consumed at least 6 servings from the grain group.

Table 4.37 presents mean servings of beverages. There were no statistically significant differences for consumption of any beverage groups. The young age groups consumed no decaffeinated teas or coffees, while elderly males reported no alcohol intake.

Elderly males consumed more servings of non-dairy creamers (Table 4.38). There also was a trend for young males to consume more servings of sugar than elderly females or young females.

There were no differences or trends of difference for intake of servings from the fat groups (Table 4.39).

Nutrient Intake

Tables 4.40 through 4.43 present nutrient intakes by age-gender. Table 4.43 displays nutrient intakes on a caloric basis.

TABLE 4.33
MEAN SERVINGS OF MEAT GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Meats	0.57b	0.56b	1.11a	0.53b	0.11	0.01**
Meats, Fattened	0.04	0.02	0.08	0.01	0.02	0.31
Meats, Processed	0.16	0.08	0.23	0.05	0.05	0.31
Fish	0.05	0.10	0.04	0.08	0.04	0.91
Fish, Fattened	0.06	0.03	0.20	0.15	0.07	0.93
Poultry	0.28	0.29	0.48	0.15	0.10	0.11
Poultry, Fattened	0.03	0.06	0.08	0.11	0.05	0.90
Eggs	0.08	0.14	0.00	0.04	0.05	0.80
Eggs, Fattened	0.00b	0.01b	0.16a	0.01b	0.03	0.03*
Beans	0.42	0.33	0.10	0.19	0.12	0.46
Beans, Fattened	0.00	0.01	0.11	0.04	0.03	0.19
Nuts	0.13	0.11	0.00	0.00	0.05	0.79
Peanut Butter	0.21	0.19	0.00	0.18	0.10	0.30
TOTAL	**2.03**	**1.93**	**2.59**	**1.54**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.34
MEAN SERVINGS OF DAIRY GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Milk, low-fat	0.58	0.76	0.21	0.27	0.23	0.78
Milk, high-fat	0.42	0.36	0.99	0.37	0.15	0.07
Cheeses/cheese sauce	0.42	0.29	1.25	0.71	0.14	0.13
Cottage Cheese	0.07	0.26	0.00	0.09	0.08	0.57
Dairy desserts	0.62	0.25	0.35	0.17	0.14	0.49
Dairy desserts, low fat	0.51	0.18	0.05	0.02	0.11	0.19
TOTAL	**2.62**	**2.10**	**2.85**	**1.63**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.35
MEAN SERVINGS OF VEGETABLE AND FRUIT GROUPS BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Fruits, Vitamin A &/or C	1.41	1.74	0.86	0.62	0.32	0.37
Fruits, Other	1.06	0.72	0.56	0.50	0.23	0.56
Dark Green Leafy Vegetables	0.35	0.27	0.14	0.14	0.08	0.69
Dark Green Leafy Vegetables, Fattened	0.01a	0.00b	0.00b	0.00b	0.00	0.03*
Potatoes	0.59	0.34	0.28	0.24	0.10	0.28
Potatoes, Fattened	0.24	0.04	0.70	0.28	0.08	0.17
Vegetables, Vitamin A &/or C	0.74	0.68	0.44	0.39	0.09	0.97
Vegetables, Vitamin A &/or C Fattened	0	0.03	0	0	0.02	0.39
Vegetables, Other	0.91	1.11	0.73	0.56	0.16	0.28
Vegetables, Other Fattened	0.12	0.06	0	0	0.03	0.38
TOTAL	**5.43**	**4.99**	**3.71**	**2.73**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.36
MEAN SERVINGS OF GRAIN GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Breads, whole-grain	0.10	0.26	0.00	0.08	0.15	0.75
Breads, Whole-grain Fattened	0.07	0.03	0.00	0.00	0.02	0.27
Breads	2.02b	1.94b	3.43a	1.61b	0.28	<0.01**
Breads, Fattened	0.48	0.71	0.55	0.61	0.21	0.67
Cereals, High-fiber	0.72	0.40	0.20	0.36	0.25	0.33
Cereals	1.14	0.44	0.65	0.56	0.24	0.21
Pastas/Rices	0.53	0.26	0.59	0.95	0.17	0.07
Pastas/Rices, Fattened	0.02	0.00	0.01	0.01	0.01	0.28
Grain-type Snacks	0.10	0.09	0.48	0.50	0.13	0.89
TOTAL	**5.18**	**4.13**	**5.91**	**4.68**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.37
MEAN SERVINGS OF BEVERAGE GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Pop/Soda	0.16	0.05	1.42	0.82	0.20	0.22
Pop/Soda, Diet	0.06	0.10	0.29	0.39	0.14	0.83
Coffee/Tea	1.20	1.24	0.21	0.33	0.31	0.91
Coffee/Tea, Decaffeinated	0.30	0.32	0	0	0.12	0.93
Alcoholic Beverage	0.00	0.13	0.21	0.32	0.15	0.95
TOTAL	**1.72**	**1.84**	**2.13**	**1.86**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.38
MEAN SERVINGS OF OTHER GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Candy	0.07	0.09	0.06	0.23	0.09	0.38
Salad-dressings, low/non-fat	0.05	0.10	0.00	0.00	0.04	0.57
Cookies	0.44	0.49	0.58	0.43	0.28	0.72
Cakes	0.1	0.13	0.05	0.16	0.06	0.52
Pies, Fruit	0.15	0.11	0.15	0.01	0.05	0.35
Pies, Other	0.05	0.01	0.00	0.00	0.01	0.12
Sweets, Other	0.00	0.00	0.00	0.01	0.01	0.47
Sugar	2.33	1.46	3.79	0.71	0.64	0.09
Sugar Substitute	0.38	0.23	0.00	0.34	0.21	0.25
Condiments	1.73	0.8	3	0.62	0.56	0.2
Sweetened Grain-type Snacks	0.00	0.19	0.43	0.23	0.14	0.18
Non-Dairy Creamers	0.55a	0.07b	0.00b	0.00b	0.09	<0.01**
Jellos	0.00	0.07	0.00	0.00	0.03	0.25
Diet Jellos	0.00	0.01	0.00	0.10	0.06	0.44
TOTAL	**5.85**	**3.76**	**8.06**	**2.84**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.39
MEAN SERVINGS OF FAT GROUPS
BY AGE-GENDER

FOOD GROUP:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Animal Fats	0.85	1.08	2.20	1.59	0.44	0.34
Vegetable Fats	1.31	1.08	0.84	0.31	0.29	0.61
Salad Dressings	0.75	0.88	0.80	1.83	0.73	0.54
Gravies/Sauces	0.35	0.41	0.10	0.13	0.16	0.89
TOTAL	**3.26**	**3.45**	**3.94**	**3.86**		

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

Table 4.40 provides data on macronutrient intake by age-gender groups. Compared to the other 3 age-gender groups, young males consumed more of the following: kilocalories, protein, total fat, saturated fat, monounsaturated fat and cholesterol. Young males also consumed more sugars than elderly females and young females, while young females consumed less disaccharides than elderly females and young males. There was a trend for elderly males to consume more carbohydrates than young females and for young males to consume more carbohydrates than elderly females and young females. There was also a trend for young males to consume more monosaccharides than all other age-gender groups and to consume more water from food sources than elderly females and young females.

Young males consumed more riboflavin than elderly males, elderly females and young females (Table 4.41). Young males also consumed more niacin and Pantothenic Acid than elderly females and young females. Young females consumed significantly less vitamin B6 than all other age-gender groups. Young males also tended to consume more niacin-equivalents than young females. Elderly females tended to consume more vitamin C than young females.

In Table 4.42, shows that young females consumed less Chloride and Copper than elderly females and young males. Young males consumed more iodine and manganese than all other age-gender groups, and consumed higher amounts of zinc than elderly females and young females. Young males also tended to consume higher levels of sodium than elderly males, elderly females and young females.

Table 4.43 displays data on mean nutrient intake for each age-gender group per 100 kilocalories. This Table indicates that many of the statistically significant differences in nutrient intake are based on calorie intake. The only differences that persist are that young males consumed more vitamin B12 and iodine than all three other age-gender groups. Young males also tended to consume a higher amount of manganese.

A lower percentage of young females than the other three age-gender groups consumed at least sixty-seven percent of the RDA for kilocalories, calcium and iron (Table 4.44). A lower percentage of young females consumed adequate amounts of zinc and chloride compared to elderly females and young males. Although not significantly different, less young females tended to consume at least sixty-seven percent or more of folate versus other age-gender groups.

Table 4.45 presents ratios of mean intake of nutrients to the RDAs for those nutrients. The

TABLE 4.40
MEAN INTAKE OF MACRO-NUTRIENTS BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Kilocalories	1731b	1475b	2292a	1484b	94.4	<0.01**
% Protein	15	17	16	15	0.91	0.16
% Carbohydrates	54	52	48	51	1.87	0.33
% Fat	31	30	35	33	1.76	0.74
% Alcohol	0	<1	<1	1	0.52	0.54
Protein, g	68.48b	64.31b	84.93a	54.62b	4.52	<0.01**
Carbohydrates, g	238.26	197.48	285.99	190.20	14.9	0.07
Comp. Carbo., g	83.32	63.49	97.95	68.90	5.55	0.41
Sugars, g	100.54a,b	96.96b	138.87a	79.53b	12.16	0.03*
Monosac., g	23.8	24.50	43.93	24.14	5.56	0.07
Disaccharides, g	26.49a,b	26.45a	35.91a	16.50b	4.23	0.03*
Total Fat, g	61.6b	52.20b	89.84a	56.58b	5.08	0.02*
Saturated Fat, g	20.91b	17.18b	33.46a	19.96b	2.02	0.02*
Monounsat. Fat, g	23.38b	19.21b	32.72a	19.68b	2.03	0.03*
Polyunsat. Fat, g	12.15	10.57	13.23	10.29	1.23	0.58
Trans-FA, g	1.14	0.93	1.38	0.29	0.3	0.15
Omega-3 FA, g	0.83	0.79	0.89	0.68	0.10	0.40
Omega-6 FA, g	8.67	45.64	7.75	6.84	41.9	0.65
Cholesterol, mg	161.96b	162.65b	320.05a	136.10b	21.9	<0.01**
Alcohol, g	0.00	0.82	2.12	3.57	1.53	0.84
Dietary Fiber, g	20.80	17.11	12.88	11.88	1.69	0.43
Soluble Fiber, g	5.74	4.56	1.93	2.37	0.53	0.13
Insoluble Fiber, g	9.59	9.42	4.74	5.91	1.33	0.61
Caffeine, mg	111.52	147.11	68.72	73.14	34.9	0.66
Water, cc	1567	1386	1978	1196	181	0.10

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.41
MEAN INTAKE OF VITAMINS
BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Biotin, mcg	24.46	22.36	13.13	9.45	3.63	0.83
Folate, mcg	285.59	294.01	277.78	179.16	33.5	0.11
Niacin, mg	18.81a,b	17.92b	24.03a	16.24b	1.65	0.04*
Niacin-equiv., mg	15.22	14.90	18.23	11.90	1.70	0.08
Pant. Acid, mg	4.23a,b	3.77b	5.28a	2.53c	0.45	0.01**
Riboflavin, mg	1.96b	1.70b	2.88a	1.42b	0.25	0.02*
Thiamin, mg	1.62	1.60	1.62	1.09	0.23	0.26
Vitamin A, Car., IU	751.76	776.76	178.38	202.99	112.9	1.00
Vitamin A, Ret., IU	506.71	556.10	957.50	387.37	234.5	0.19
Vitamin A, Total, IU	1296.79	1365.29	1282.31	645.88	253.9	0.17
Vitamin B6, mg	1.68a	1.59a	1.94a	1.13b	0.14	0.02*
Vitamin B12, mcg	3.88b	4.34b	13.92a	3.11b	2.27	0.02*
Vitamin C, mg	102.94	144.55	114.91	62.17	25.4	0.07
Vitamin D, mcg	4.04	4.19	4.64	3.01	0.68	0.20
Vitamin E, mg	8.4	7.37	5.47	4.39	1.12	0.99
Vitamin K, mcg	88.67	84.26	22.55	38.35	16.5	0.54

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.42
MEAN INTAKE OF MINERALS
BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Boron, mg	9.50	7.86	6.33	2.86	1.21	0.45
Calcium, mg	835.95	851.73	1019.20	642.22	124.8	0.12
Chloride, mg	507.04a,b	643.17a	763.18a	429.94b	90.1	0.01**
Chromium, mcg	8.07	7.49	3.82	2.90	1.17	0.89
Copper, mg	1.15a,b	1.13a	1.35a	0.84b	0.12	0.05*
Iodine, mcg	83.88b	112.06b	417.44a	49.03b	77.9	0.01**
Iron, mg	15.14	12.93	15.63	11.29	1.47	0.47
Magnesium, mg	294.29	264.56	233.58	189.13	24.4	0.76
Manganese, mg	3.37b	2.88b	9.84a	2.20b	1.51	0.02*
Molybdenum, mcg	27.53	21.82	15.99	13.96	4.35	0.67
Phosphorus, mg	1228.05	1128.43	1372.78	936.58	104	0.11
Potassium, mg	3014.33	2868.35	2519.48	1737.35	255	0.22
Selenium, mcg	66.89	61.89	81.58	83.90	15.7	0.82
Sodium, mg	2494.48	2193.58	3380.48	2348.83	202	0.07
Zinc, mg	9.55a,b	8.79b	12.01a	7.25b	0.86	0.02*

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.43
MEAN INTAKE OF NUTRIENTS PER 100 KILOCALORIES BY AGE-GENDER

NUTR. COMP. PER 100 KCAL:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Kilocalories	1731b	1475b	2292a	1484b	94.4	<0.01**
Protein, g	3.95	4.39	3.80	3.72	0.23	0.26
Fiber, g	1.18	1.18	0.56	0.83	0.10	0.19
Folate, mcg	16.65	20.00	11.60	12.71	1.96	0.57
Niacin, mg	1.11	1.23	1.08	1.10	0.09	0.64
Riboflavin, mg	0.12	0.12	0.12	0.10	0.01	0.36
Thiamin, mg	0.10	0.11	0.07	0.08	0.02	0.73
Vitamin A, RE	74.15	92.59	56.07	46.24	12.9	0.28
Vitamin B6, mg	0.10	0.11	0.08	0.08	0.01	0.34
Vitamin B12, mcg	0.23b	0.29b	0.60a	0.21b	0.10	0.03*
Vitamin C, mg	4.92	5.79	0.87	2.84	1.10	0.62
Vitamin D, mcg	0.24	0.28	0.19	0.20	0.04	0.72
Vitamin E, mg	0.48	0.50	0.24	0.29	0.07	0.73
Vitamin K, mcg	0.05	0.06	<0.01	0.03	<0.01	0.62

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.43 (cont'd.)
MEAN INTAKE OF NUTRIENTS PER 100 KILOCALORIES
BY AGE-GENDER

NUTR. COMP. PER 100 KCAL:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Biotin, mcg	1.34	1.50	0.52	0.63	0.21	0.92
Calcium, mg	47.87	56.13	44.08	43.30	5.98	0.45
Chloride, mg	28.93	43.69	30.79	29.07	4.86	0.10
Chromium, mg	0.47	0.52	0.16	0.21	0.08	1.00
Copper, mg	0.07	0.08	0.06	0.06	0.00	0.40
Iodine, mcg	4.91b	7.30b	16.54a	3.22b	3.25	0.02*
Iron, mg	0.89	0.88	0.69	0.77	0.09	0.57
Magnesium, mg	16.91	18.07	9.95	12.83	1.29	0.51
Manganese, mg	0.19	0.20	0.41	0.16	0.07	0.06
Molybdenum, mcg	1.58	1.48	0.63	1.00	0.29	0.41
Pant. Acid, mg	0.24	.26	0.22	0.17	0.02	0.14
Phosphorus, mg	70.46	76.25	59.00	63.39	4.67	0.88
Potassium, mg	171.64	194.46	107.93	120.52	12.5	0.68
Selenium, mcg	3.90	4.26	3.58	5.49	0.98	0.43
Sodium, mg	145.51	148.98	155.23	161.97	12.2	0.89
Zinc, mg	0.55	0.60	0.52	0.49	0.05	0.42

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.44
PERCENT OF THOSE WHOSE INTAKE MET 67%
OF RDA/ESAI
BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Kilocalories	71a,b	88a	90a	50b	11.62	0.02*
Protein	100	100	100	95	3.44	0.47
Fiber	57	22	10	5	10.6	0.16
Folate	100	100	90	60	8.43	0.08
Niacin	100	97	100	80	7.21	0.25
Riboflavin	100	100	90	90	5.80	1.00
Thiamin	100	100	90	80	7.15	0.49
Vitamin A	86	94	60	50	11.2	0.43
Vitamin B6	71	91	70	55	11.8	0.15
Vitamin B12	100	100	100	80	6.32	0.12
Vitamin C	100	100	80	60	8.93	0.27
Vitamin D	71	56	30	10	12.8	0.85
Vitamin E	57	69	30	30	13.6	0.67
Vitamin K	43	72	10	20	12.4	0.45

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.44 (cont'd.)
PERCENT OF THOSE WHOSE INTAKE MET 67%
OF RDA/ESAI
BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Biotin	29	9	0	0	7.19	0.19
Calcium	71a	84a	70a	25b	12.0	0.02*
Chloride	29a,b	63a	60a,b	30b	13.9	0.02*
Chromium	0	0	0	0	0.00	--
Copper	29	16	20	5	10.1	0.92
Iodine	43	34	50	10	12.8	0.22
Iron	100a	97a	100a	50b	8.63	<0.01**
Magnesium	86	91	50	40	11.6	0.52
Manganese	71	66	60	25	13.6	0.29
Molybdenum	0	0	0	0	0.00	--
Pantothenic Acid	71	50	50	5	12.7	0.36
Phosphorus	100	100	90	65	8.24	0.13
Potassium	100	100	90	65	8.24	0.13
Selenium	100	100	70	75	8.54	0.77
Sodium	100	100	100	100	0.00	--
Zinc	43a,b	53a	80a	25b	13.7	0.02*

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.45
RATIO OF MEAN INTAKE TO "RECOMMENDED"
(BY RDA/ESAI)
BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Kilocalories	0.75	0.77	0.79	0.67	0.04	0.09
Protein	1.09a,b	1.29b	1.46a	1.19b	0.09	<0.01**
Fiber	0.69	0.57	0.43	0.40	0.06	0.43
Folate	1.43	1.63	1.39	1.00	0.18	0.10
Niacin	1.25	1.38	1.26	1.08	0.11	0.17
Riboflavin	1.40	1.42	1.69	1.10	0.16	0.06
Thiamin	1.35	1.60	1.08	0.99	0.22	0.44
Vitamin A	1.30	1.71	1.28	0.81	0.28	0.12
Vitamin B6	0.84a,b	0.99a	0.96a	0.71b	0.08	0.02*
Vitamin B12	1.94b	2.17b	6.96a	1.55b	1.14	0.02*
Vitamin C	1.72	2.41	1.91	1.04	0.42	0.07
Vitamin D	0.81	0.84	0.46	0.30	0.11	0.36
Vitamin E	0.84	0.92	0.55	0.55	0.13	0.77
Vitamin K	1.11	1.30	0.32	0.64	0.25	0.80

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

TABLE 4.45 (cont'd)
RATIO OF MEAN INTAKE TO "RECOMMENDED"
(BY RDA/ESAI)
BY AGE-GENDER

NUTRIENT:	ELDERLY MALES:	ELDERLY FEMALES:	YOUNG MALES:	YOUNG FEMALES:	SEm:	IA (P<):
Num. of subj. (n) =	7	32	10	20		
Biotin	0.38	0.34	0.20	0.15	0.06	0.83
Calcium	1.04	1.06	0.85	0.54	0.15	0.25
Chloride	0.68a,b	0.86a	1.02a	0.57b	0.12	0.01**
Chromium	0.07	0.06	0.03	0.02	0.01	0.89
Copper	0.51a,b	0.50a	0.60a	0.38b	0.05	0.05*
Iodine	0.56b	0.75b	2.78a	0.33b	0.52	0.01**
Iron	1.51a	1.29a	1.56a	0.75b	0.13	0.03*
Magnesium	0.84	0.94	0.67	0.68	0.08	0.57
Manganese	0.96b	0.82b	2.81a	0.63b	0.43	0.02*
Molybdenum	0.17	0.13	0.10	0.09	0.03	0.67
Pantothenic Acid	0.77a,b	0.69b	0.96a	0.46c	0.08	0.01**
Phosphorus	1.54	1.41	1.14	0.78	0.11	0.28
Potassium	1.51	1.43	1.26	0.87	0.13	0.22
Selenium	0.96	1.13	1.17	1.53	0.28	0.74
Sodium	4.98	4.39	6.76	4.70	0.40	0.07
Zinc	0.64a,b	0.73a,b	0.80a	0.60b	0.07	0.03*

*Age-gender interaction significantly different at $p < 0.05$
**Age-gender interaction significantly different at $p < 0.01$

ratios for young males are significantly higher than elderly females or young females for protein and pantothenic acid. Young males also had higher ratios for vitamin B12, iodine and manganese than all other age-gender groups. The ratio for zinc for young males was higher than young females. Young females' ratio was less for vitamin B6, copper and chloride versus elderly females and young males, and less for iron versus all three other age-gender groups. Young females also had a lower ratio for pantothenic acid versus elderly males. Elderly females tended to have a higher ratio for vitamin C and folate than young females. Elderly females and young males tended to have a higher ratio for kilocalories and riboflavin than young females.

Summary for Age-Gender Interaction

Few differences in food groups (major or specific groups) existed in relation to age-gender. There appeared to be a pattern that young males generally consumed more nutrients and nutrient components, however young females also had a pattern of lower intake of some nutrients and nutrient components. When based on calories, most of the nutrient and nutrient component differences not longer existed (exceptions were that young males persisted with higher vitamin B12 and iodine intake).

Those differences that existed for the percent of subjects that consumed at least 67% of the RDA/ESADDI were basically for minerals and were young female driven (less subjects attained 67% of the RDA/ESADDI). Differences that existed for the ratio of mean intake to the recommended by RDA/ESADDI had two patterns - young males had higher ratios, while young females had lower ratios.

CHAPTER 5

DISCUSSION

The comparisons to guidelines (i.e. FGP, NCEP) for physical measures, food groups, nutrient intake and nutrient component intake are compared in Chapter 4 with the data/results. This chapter will discuss these results.

Gender

Physical Measures

Elderly Males versus Females: Middle-aged Females have been reported to have a lower risk for CVD, and it has been postulated that this was due to the estrogenic effects; after menopause, CVD incidence increases. This group of elderly postmenopausal females had mean serum cholesterol concentrates greater than NCEP recommendations. However, Rosser (1993) and Atrens (1994) have indicated that it is questionable whether serum cholesterol reduction actually decreases CVD risk.

Young Males versus Females: The height, weight and BMI of young males and young females can be compared to data from Basiotis, et al. (1989), as follows:

		Current Study	Basiotis, et al.
Males:	Height	179.07 cm	174.75 cm
	Weight	77.9 kg	76.3 kg
	BMI	24.3	25.1
Females:	Height	166.01 cm	160.53 cm
	Weight	58.6 kg	60.0 kg
	BMI	21.3	23.2

The current study's young males mean height was slightly taller compared to the findings of Basiotis, et al. (1989), with a slightly higher average weight and a slightly lower BMI. Young females from this study had similar heights to the Basiotis, et al. (1989) study, however this study's young females had a lower mean weight and BMI. Kuczmarski, et al. (1994) also has provided a value of comparison; these authors indicated that the population of the US, $\geq$20 years of age, have a BMI value of 26.3 - this is a higher BMI value than found in either the young males or females in this study. Both

young males and young females were within the range of healthy BMI values (19-24) that Willett, et al. (1995) stated was appropriate for decreasing disease.

Ideal body weight, percent ideal body weight and body mass index are frequently used for assessment of appropriateness of weight. Although the young subjects' values for these parameters were within normal ranges, none of them measured body fat or lean body mass with any accuracy (Garrow, 1988).

Food Group Servings

As this study's males consumed more kilocalories than females, one would expect that there may be differences in the intake of food groups. The pattern of food groups that were consumed in larger amounts by males included red meat, dairy and grain. These food groups provide nutrients that may be at risk for adult females (i.e. red meat - iron, zinc; dairy - calcium, riboflavin; grains - B vitamins, iron). Low servings in these groups for females help explain low nutrient intakes for the females. Based upon the 1995 U.S. Dietary Guidelines (USDHHS, 1995) and the FGP, variety is needed for a more optimal diet. This study's subjects had a low number of servings from each of the groups - meats, dairy, vegetables, fruits and grains - which does not allow for much variety in selection of foods.

The highest contributors (in descending order of servings - i.e. highest serving, second highest serving) of various food groups provides a view of selection patterns for males versus females. The basis of this discussion is the isolation of approximately the top one-third from each food group division. The following provides an overview of major contributors to total servings for the food groups for males and females:

	Major groups:	Meat/meat equivalent group - percent:
♂:	other, grains, fats, dairy	meats, poultry, fattened beans - 65%
♀:	grains, fats, other, vegetables	meats, poultry, beans - 59%

	Dairy group - percent:	Fruit group - percent:
♂:	cheeses, high fat milks - 57%	↑ vitamin A and/or C - 58%
♀:	low fat milks, cheeses - 54%	↑ vitamin A and/or C - 66%

	Vegetable group - percent:	Grain group - percent:
♂:	other, ↑ vitamin A/C, fat. potatoes - 72%	breads, cereals, pastas/rices - 75%
♀:	other, ↑ vitamin A/C, potatoes - 81%	breads, fattened breads, pastas/rices - 69%

	Beverage group - percent:	Other group - percent:
♂:	pop/soda, coffee/tea - 73%	sugar, condiments, cookies, ND creamers - 90%
♀:	coffee/tea, pop/soda - 66	sugar, condiments, cookies, sugar substitute - 77%

	Fat group - percent:
♂:	animal fats, vegetable fats - 72%
♀:	salad dressings, animal fats - 74%

Identification of the highest contributors to food groups by servings provides information on selection patterns. It appeared for males and females, the bases for selections are similar, but the order of selection as well as fat content of items may be different. Frequently, a gender group tended to select one item differently than the other gender group to complete the list. The change in order and/or selection of different foods may represent attempts to select healthier/lower calorie foods based upon perception of what are healthier/lower calorie food choices (i.e. selection of salads resulting in salad dressings as major contributor to fat group servings). Some differences in selection may represent "trade off" selections. "Trade off" selections are ones that are made to trade a lower fat food for a higher fat food, allowing a person to consume a higher fat food of preference (i.e. selection of skim milk in order to consume cheese).

Further considerations for servings include a look at the information provided by percentages of total servings. These percentages may give insight into elasticity in selection of foods, "staples" or "core" foods in the diet and variety in selection. A higher value may indicate that there was less elasticity in selection of foods. Elasticity indicates the subjects' flexibility in food choices. A higher percentage indicates inelastic food selections. These sets within the food groups may represent "core" foods for each set of subjects. Another important point is that the percentages of total servings that these sets each provide may also indicate variety in the diet. A lower percentage provided by the set of foods to the total servings indicates that choices were made from a larger assortment of foods to provide the total servings of the major food groups. The table above indicates that females had more elasticity in selection of foods that contributed to the meat, grain, beverage and other groups than males. The higher percentages indicate that females had lower elasticity in selection of foods contributing to total

servings of vegetables, other and fats, while males had lower elasticity in selection of foods contributing to vegetables, grains, beverages, other and fats total servings.

Table 5.1 provides a comparison of the actual food groups consumed to the EAT II study (NLSMB, 1993). The current study's subjects had similar intake of servings as the subjects from the EAT II study for grains, vegetables and meats. It is interesting to note that the present study's subjects actually consumed more servings of fruits, dairy and other food groups. The large differences for the servings from the other groups is likely due to differences in tallying for this study. The current study totals beverages, other and fat groups to represent the other groups from the FGP. These beverages and other groups include some foods that are not necessarily high in fats or sugars (i.e. black coffee, diet pop, condiments), and EAT II refers specifically to fats, oils and sweets. Caffeinated beverages in the form of pop/soda and coffee/tea were the major contributors to servings in the beverage group, while sugar and condiments were the major contributors to the other groups. Of those "foods" (animal fats, vegetable fats, salad dressings, gravies/fat-based sauces) listed to contribute to the fat group for the current study, only gravies/fat-based sauces played a minor role. It is disappointing to see the low intake of grains - considerations must also include that subjects may have under reported grain portion sizes.

The EAT II study (NLSMB, 1993) indicated that subjects perceived that they were consuming close to the recommended servings from the FGP. This study did not identify the study populations, perception of their intake compared to the FGP.

Several other studies have information for comparison to the data from this study. Men from this study consumed more servings of all food groups than females, while Randall, et al. (1989) reported that men consumed more servings from the meat, grain, nuts and alcohol groups than women, and women consumed more foods from the fruits, vegetables and poultry and fish groups. Byers' (1993) data indicated that the population studied consumed 2.5 servings of fruits and vegetables and only 3 serving of grains. In both of these studies the reported food group intake were lower than this study's subjects' intakes (4.57 servings of fruits and vegetables for males, 3.86 servings for females; 5.54 servings grains for males and 4.40 servings for females).

TABLE 5.1
FOOD GROUP INTAKE BY GENDER - A COMPARISON OF STUDIES

FGP GUIDELINES	EAT II MALES	STUDY MALES	EAT II FEMALES	STUDY FEMALES
Grains/6-11	5.8	5.54	4.6	4.40
Vegetables/3-5	2.4	2.62	2.0	2.07
Fruits/2-4	1.0	1.95	1.0	1.79
Dairy/2-3	1.2	2.74	1	1.86
Meats/2-3	2.8	2.27	1.9	1.75
Other/ Use Sparingly	4.1	1.92 Beverage 6.92 Other 3.60 Fat 12.44 Total	3.2	1.84 Beverage 3.30 Other 3.65 Fat 8.79 Total

Nutrient Intake

Males and females consumed similar amounts of protein, carbohydrates, fat and alcohol as percentages of kilocalories. The macronutrient makeup for both males and females (males: 16% protein, 51% carbohydrates, 33% fat, <1% alcohol; females 16% protein, 51% carbohydrates, 32% fat, <1% alcohol) are still high for protein, low in carbohydrates and high in fat based upon the U.S. Dietary Goals of 12% protein, 58% carbohydrates and ≤30% fats.

Table 5.2 compares the subjects' average daily nutrient intake and that of the EAT II study (NLSMB, 1993). This table indicates that this study's group food group consumption was similar to that of the EAT II subjects. The study's males consumed slightly more calories than the study's females. The current study's males and females both consumed a slightly higher percentage of calories from carbohydrates. Both genders from the current study group consumed a lower percent of calories from fat, as well as cholesterol and sodium when compared to the EAT II subjects.

Considering nutrient and nutrient component intake for the current study's subjects, sugar intake was high for both males and females (24% of calories). The fats as a percentage of calories is more than desirable for SFA and MUFA (males - 12.1% and 12.5% respectively; females 11.3% and 11.8%, respectively) and lower than desirable for PUFA (males - 5.7%; females - 6.3%) - fat content of both males' and females' diets has room for improvement for a more optimal diet. Although fiber intake was inadequate, intake for males was slightly lower than the values from USDHHS, while females were slightly higher (current study's females - 14.5 g/day versus USDHHS figures of 12 g/day; current study's males - 16.84 versus USDHHS figures of 18 g/day) Water (as analyzed from foods and any liquids from the dietary records) appears to be low, but very few subjects reported glasses of water on food records - this must be considered for overall water intake.

Males generally consumed higher amounts of vitamins and minerals based on reported intake. However, when intake of these nutrients was based upon calorie intake, there were no differences that persisted between males and females. From this information, it may be concluded that these subjects' vitamin and mineral intake was calorie driven. The calcium and phosphorus intake for this study's males and females resulted in less than desirable ratios (calcium to phosphorus ratio was 0.71:1.00 for

TABLE 5.2
NUTRIENT INTAKE BY GENDER - A COMPARISON OF STUDIES

NUTRIENT COMPONENT	EAT II MALES	STUDY MALES	EAT II FEMALES	STUDY FEMALES
Kilocalories	1891	2012	1447	1479
Protein, g	79.2	76.69	58.8	59.47
Percent Protein	16.8%	15.2%	16.3%	16.1%
Carbohydrates, g	218.4	262.12	174.3	193.84
Percent Carbohydrates	46.2%	52.1%	48.2%	52.4%
Total Fat, g	78.1	75.72	58.4	54.39
Percent Fat	37.2%	33.9%	36.3%	33.1%
SFA, g	27.6	27.19	20.6	18.57
Percent SFA	13.1%	12.2%	12.8%	11.3%
MUFA, g	29.4	28.05	21.6	19.45
Percent MUFA	14.0%	12.5%	13.4%	11.8%
PUFA, g	14.9	12.69	11.6	10.43
Percent PUFA	7.1%	5.7%	7.2%	6.3%
Cholesterol, mg	305.5	241.01	225.3	149.37
Iron, mg	13.6	15.38	10.6	12.11
Zinc, mg	11.6	10.78	8.6	8.02
Sodium, mg	3469.6	2935.98	2631.9	2271.20

males and 0.72:1.00 for females) compared to the recommended ratio for adults by Dwyer, et al. (1994) of 1.00:1.00. This ratio is for most appropriate bone retention to decrease risk for osteoporosis. Sodium to potassium ratios (Na:K of 4.25:1.00 for males, 3.95:1:00 for females) were also higher than recommended for decreasing disease risk (Dwyer, et al., 1994). More research is needed on trace mineral content (i.e. molybdenum and chromium) in foods to more accurately assess intake of these minerals.

Although there were few statistically significant differences in percentages of subjects that consumed 67% or more of the RDA/ESADDI, more than 90% of males were able to attain the 67% level for six vitamins versus only for three vitamins for females. Minerals had a similar pattern; ninety percent of males were able to attain this standard for three minerals (of which one was sodium), while more than or equal to ninety percent of females were able to attain this standard for only one mineral (sodium). This information of percentage of subjects that consumed at least the standard of 67% or more of the RDA/ESADDI is rather dismal - many individuals from this study had diets there were quite low in nutrient and nutrient component intake.

Regarding the specific intake compared to the RDA/ESADDI, patterns of nutrients and nutrient components that may be considered at risk for these subjects were similar. Both genders had mean intakes that were less than 67% of the RDA/ESADDI for fiber, vitamin D, biotin, copper, molybdenum and chromium. Females also had mean intakes that were low for iodine and pantothenic acid.

Summary for Gender

With the exception of percent ideal body weight, males had different anthropometric measures than females. Selection of major food groups as well as specific food groups were similar for males and females, however there were instances in which the order of selection for highest contributors to servings varied. Females also tended to select a different grouping as a part of their top one-third selections. Generally speaking on nutrients and nutrient components, males and females could improve their diet and selection of foods to improve intake and ratios of nutrients.

Food Group Servings

Although the young subjects from the current study consumed more kilocalories than the elderly subjects, the young subjects did not necessarily consume more servings from the food groups (general or specific groups). The elderly subjects consumed more nuts, fruits and vegetables than the young subjects - these are foods that can contribute to some nutrients that are recommended to be increased in the diet (i.e. MUFA, fiber, carbohydrates).

The following is an overview of the highest contributors (approximate top one-third servings) to total servings for all food groups based upon age.

Major food groups:
Elderly: other, grains, fats, vegetables
Young: other, grains, fats, other/dairy

Dairy groups:
Elderly: LF milks, dairy desserts - 47%
Young: cheeses, high fat milks - 74%

Vegetable groups:
Elderly: other, ↑ vitamin A/C, potatoes - 80%
Young: other, fat. potatoes, ↑ vitamin A/C - 80%

Beverage group:
Elderly: coffee/tea, decaffeinated coffee/tea - 86%
Young: pop/soda, diet pop/soda - 73%

Fat group:
Elderly: vegetable fats, animal fats - 64%
Young: animal fats, salad dressings - 66%

Meat/meat equivalents group:
meats, fattened beans, poultry - 62%
meats, poultry, fattened fish - 66%

Fruit groups:
↑ vitamin A and/or C - 64%
↑ vitamin A and/or C - 58%

Grain group:
breads, cereals, fattened breads - 72%
breads, pastas/rices, cereals - 74%

Other group:
sugar, cond., cookies, NDC/sugar substitute - 89%
sugar, cond., cookies, sweet. grain. snacks - 90%

From this table it appears that the bases for foods chosen as major contributors were similar for the major food, meat/meat equivalents, fruit, vegetable, grain and other groups, however the order of selection differed; each age group selected the last major contributor differently than the other age group. It also appears that selections of foods within the dairy and beverage groups were very different. From the low percentage of total servings provided by the major contributors, elderly subjects consumed a greater variety of foods within the dairy group. Several food groups were consumed with relative inelasticity as indicated by the higher percentages that these major contributors provided toward total servings. These included dairy (young), vegetables (elderly and young), grains (elderly and young),

beverages (elderly and young) and other (elderly and young).

Overall, elderly subjects consumed more fruits and vegetables. Young subjects consumed more of the foods that are significant contributors to fat in the diet - meats and cheeses. Young subjects appear to be less concerned with saturated fats; these subjects had a higher intake of animal source fats, while elderly subjects consumed more vegetables fats. As mentioned in the literature review, it should also be considered that many people cannot accurately identify all sources of fats, including saturated fats (NLSMB, 1993; USDHHS, 1990).

Selection patterns of groups within the specific food groups was apparent. It appeared that for the elderly and young, although bases of selection were similar, the order of selection of items and "one item" differences existed. Foods from the dairy and beverage groups appeared to be selected differently. Many of these differences may be related to location of food consumption. Another factor for differences in food choices by age group may related to how the age groups were raised. The elderly population may have had garden foods, including fruits and vegetables, as a significant source of foods. The younger population on the other hand was a generation that may have been more exposed to restaurant and fast food meal consumption. Age differences themselves are likely factors. Elderly people may be making conscious efforts to make selections of foods that they perceive as more healthy. This may be based upon the fact that age and chronic disease are facing the elderly, while young subjects are still at an age that chronic disease is not perceived as a threat to them.

As with Gender, there was a low intake of grains, including high fiber sources of grains. Considerations must include that subjects under reported grain servings (related to problems of estimating portion sizes), however Table 5.3 does not indicate that this is the case. Comparing the number of servings from each of these foods groups, it appears that the current study's subjects consumed more servings from various food groupings than the subjects from the Cronin, et al. (1982) study. Both young and elderly subjects from the current study consumed more servings from the dairy, fruits and vegetables combined, bread, sweets/desserts and fats. The current study's young subjects consumed slightly more fruits than those subjects from Cronin's study while Cronin's young subjects consumed more coffee and tea, and diet sodas/pop. The current study's elderly subjects consumed more

TABLE 5.3
FOOD GROUP INTAKES BY AGE - A COMPARISON OF STUDIES

	Current Study Young Group	Cronin, 1982 Young	Current Study Elderly Group	Cronin, 1982 Elderly
Meats (all)	1.97	1.9	2.00	1.9
Dairy	2.25	1.6	2.36	1.8
Fruits & Vegetables	3.23	2.7	5.22	3.2
Vegetables	1.96	2.0	2.75	2.1
Fruits	1.27	1.1	2.47	1.5
Breads & Cereals	5.30	2.2	4.65	2.5
Sweets & Desserts	4.54	2.7	2.94	2.4
Fats	4.89	1.3	3.36	1.6
Coffee & Tea	0.27	1.9	1.22	2.2
Diet Sodas/Pop	0.34	0.9	0.08	0.7

servings from each of the fruit and vegetables groups. The higher intake of coffee, tea, and diet sodas/pop by the Cronin subjects persisted with the elderly age groups.

Nutrient Intake

Elderly and young subjects had differences in distributions of macronutrients. Although, still not at the recommended values (U.S. Dietary Goals of 12% protein, 58% carbohydrates and less than or equal to 30% fats), the elderly had more favorable percentages of calories from carbohydrates and fat than young subjects. Sugar intake represented 25% and 23% of calories for elderly and young subjects respectively; these intakes were higher than the U.S. Dietary Guidelines indicate ($\leq$10% of total calories). Both age groups did not have recommended percentages from each SFA, PUFA and MUFA, but elderly subjects were closer to those recommendations - 10.7% SFA, 6.38% PUFA and 12.0% MUFA; young - 12.7% SFA, 5.6% PUFA and 12.5% MUFA). Young subjects appear to have made selections of foods without considerations of fat quality or quantity. As mentioned in the gender discussion, this may also be related to the difficulty of people in identifying those foods high in fat and saturated fats in a hidden form (i.e. some baked items). Elderly subjects may have made conscious efforts to have more fiber in their diet, but the effect of the Congregate Meals should be considered.

The calcium to phosphorus ratio for both age groups was 0.72:1.00. Elderly subjects had a sodium to potassium ratio of 0.80:1.00, while young subjects had a 1.35:1.00 ratio. The ratios of calcium to phosphorus for both age groups and the young subjects' sodium to potassium ratio may not be appropriate to decrease risk for disease. According to Dwyer, et al. (1994), ratios of 1:1 for these minerals would be more acceptable.

Table 5.4 provides some age comparisons from other studies. The current study's elderly subjects had several differences compared to the studies of Butterworth, et al. (1993), Edelstein, et al. (1992) and Popkin, et al. (1992). Compared to the study of Butterworth, et al. (1993), the current study's elderly subjects consumed slightly less percent of calories from PUFA, slightly more fiber and less cholesterol. Considering the study of Edelstein, et al. (1992), the current study's elderly subjects consumed less calories, fiber and cholesterol, and slightly less SFA. Comparing the current study to that

TABLE 5.4
MACRONUTRIENT INTAKES BY AGE - A COMPARISON OF STUDIES

	Current Study Elderly	Butterworth, et al., 1993 Elderly	Edelstein, et al, 1992 Elderly	Popkin, et al., 1992 Elderly	Current Study Young	Willett, et al., 1987 Young
Kcal	1603	1598	1792	1581.3	1888	2229
% Pro	16	16.1	--	--	15	14.7
% CHO	53	53.9	--	47.3	49	46.3
% Fat	31	32.1	31.9	36.0	34	36.3
% SFA	11	10.8	10.8	12.5	13	13.5
% PUFA	6	7.1	--	--	6	--
% MUFA	12	11.9	--	--	12	--
% Alc	<1	--	--	--	<1	--
Pro, g	66.38	64.3	--	--	69.77	82.0
CHO, g	217.87	215.5	--	--	238.09	258
Fiber, g	18.96	17.9	21.2	13.6	12.38	--
Tot. Fat, g	56.90	57.0	63.6	64.2	73.21	89.9
SFA, g	19.04	19.2	21.6	--	26.71	33.5
PUFA, g	11.36	12.6	--	--	11.76	--
MUFA, g	21.29	21.2	--	--	26.20	--
Chol, mg	162.30	206.2	287	266.7	228.07	362

of Popkin, et al. (1992), elderly subjects consumed a higher percent of calories from carbohydrates; less total fat, percent of calories from fat, and cholesterol; and more fiber.

When compared to the study from Willett, et al. (1987), Table 5.4 shows the current study's young subjects consumed less calories, protein, carbohydrates, total fat, SFA and cholesterol; slightly higher percent of calories from carbohydrates and slightly lower percent of calories from fat.

Nutrient intake based on calories provided some interesting data. With the exception of sodium, the majority of nutrients that the elderly subjects consumed in higher amounts than the young subjects may be due to the greater variety in food group selections as well as more nutrient dense food selections within these food groups. The information on nutrient intake based on calories (Table 4.29, pages 77-78) supports this statement regarding higher nutrient density. Location of meals consumed is a consideration for effects on concentration of nutrients.

There were numerous statistically significant differences in percentages of subjects that consumed 67% or more of the RDA/ESADDI. Equal to or greater then 90% of elderly subjects were able to attain the 67% level for six vitamins versus only three occurrences of attainment of the 67 % level for young subjects. Minerals had a similar pattern, whereby 90% of elderly subjects were able to attain this standard for five minerals (of which one was sodium), while more than or equal to 90% of young subjects were able to attain this standard for only one mineral (sodium). This information of percentage of young subjects that consumed at least the standard of 67% indicates many young individuals from this study had a diet that was quite low in nutrient/nutrient component intake.

Regarding the specific intake compared to the RDA/ESADDI, different patterns of nutrients/nutrient components that may be considered at risk for both age groups existed. Both age groups had mean intakes that were less than 67% of the recommended for fiber, biotin, copper, molybdenum and chromium. Young subjects were also at risk for vitamin D, vitamin E and vitamin K, while elderly subjects were also at risk for iodine.

Summary for Age

Although not attaining the recommended servings, elderly subjects made selections of foods

that were more aligned with the guidelines of the FGP and the "Five-a-Day" campaign, while young subjects did not. The overall pattern of food selection by elderly subjects provided a diet that had more appropriate percentages of calories from macronutrients, higher fiber and generally a more nutrient dense diet. Elderly subjects also had a higher percentage of subjects meeting the standard of 67% of the RDA/ESADDI compared to young subjects.

Age-Gender Interaction

Food Group Servings

A look at the highest contributors to various food groups provides an overview of selection patterns for elderly and young males and females. As with age and gender, the basis of these tables provided is the isolation of the top one-third (approximately) from each food group divisions.

Major food groups:

Elderly males:	other, grain, fat, vegetable
Elderly females:	grain, other, fat, vegetable
Young males:	other, grain, fat, dairy
Young females:	grain, fat, other, dairy

Meat/meat equivalents groups:

Elderly males:	meats, beans, poultry - 63%
Elderly females:	meats, beans, poultry - 61%
Young males:	meats, poultry, processed meats - 70%
Young females:	meats, beans, peanut butter - 58%

Dairy group:

Elderly males:	dairy desserts, low fat milks - 46%
Elderly females:	low fat milks, high fat milks - 53%
Young males:	cheeses, high fat milks - 79%
Young females:	cheeses, high fat milks - 66%

Fruit groups:

Elderly males:	high vitamin A and/or C - 57%
Elderly females:	high vitamin A and/or C - 71%
Young males:	high vitamin A and/or C - 61%
Young females:	high vitamin A and/or C - 55%

Vegetable groups:

Elderly males:	other, high vitamin A and/or C, potatoes - 76%
Elder. females:	other, high vitamin A and/or C, potatoes - 43%
Young males:	other, fattened potatoes, high vitamin A and/or C - 82%
Young females:	other, high vitamin A and/or C, fattened potatoes - 45%

Grain group:
Elderly males: breads, cereals, high fiber cereals - 75%
Elderly females: breads, fattened breads, cereals - 75%
Young males: breads, cereals, pastas/rices - 79%
Young females: breads, pastas/rices, cereals - 68%

Beverage group:
Elderly males: coffee/tea, decaffeinated coffee/tea - 87%
Elderly females: coffee/tea, decaffeinated coffee/tea - 85%
Young males: pop/soda, diet pop/soda - 80%
Young females: pop/soda, diet pop/soda - 65%

Other group:
Elderly males: sugar, condiments, non-dairy creamers, cookies - 86%
Elderly females: sugar, condiments, cookies, sweetened grain-type snacks - 76%
Young males: sugar, condiments, cookies, sweetened grain-type snacks - 97%
Young females: sugar, condiments, cookies, sugar substitutes - 74%

Fats group:
Elderly males: vegetable fats, animal fats - 66%
Elderly females: animal fats, vegetable fats - 63%
Young males: animal fats, vegetable fats - 77%
Young females: salad dressings, animal fats - 87%

Similar to the age and gender groupings, there is a base of foods selected that were major contributors to total servings from each food group. There were also differences in order of selections, and usually there was one food type selected differently by one or more age-gender group. The change in order of selection is likely due to personal preferences that may be related to generational differences (i.e. elderly subjects may have been "raised" on a diet higher in fruits and vegetables, young subjects may have been "raised" on fast foods; young females attempting to select foods to control calorie intake or health related differences (i.e. young subjects not concerned with chronic disease).

This overview provides some insight into possible inelasticity of selection of foods for each food group. From the representation of low percentages from the above table, there appears to have been some variety in selection. Elderly males appeared to have chosen more variety for foods contributing to total servings for the dairy group. Both elderly females and young females appeared to have more variety in vegetable selections.

Table 5.5 goes a step further in examining the age gender food group intake data and provides a comparison of the food groups consumed to the EAT II study (NLSMB, 1993). The current study's subjects had similar intake of servings as the subjects from the EAT II study for grains, vegetables and

TABLE 5.5
NUTRITIONAL COMPONENTS INTAKES BY AGE-GENDER - A COMPARISON OF STUDIES

	Current Study Eld Males	NHANES II 76-80 Eld Males	Current Study Yng Males	NHANES II 76-80 Yng Males	Current Study Eld Females	NHANES II 76-80 Eld Females	Current Study Yng Females	NHANES II 76-80 Yng Females
Kcal	1731	1818	2292	2746	1475	1301	1484	1633
% Pro	15	16.1	16	15.7	17	15.7	15	15.4
% CHO	54	44.2	48	42.4	52	48.9	51	45.3
% Fat	31	37.1	35	36.7	30	35.3	33	36.9
% SFA	10.9	13.4	13.1	13.4	10.5	11.8	12.1	13.2
Pro, g	68.48	73	84.93	108	64.31	51	54.62	63
CHO, g	238.26	201	285.99	291	197.48	159	190.20	185
Tot Fat, g	61.6	75	89.84	112	52.20	51	56.58	67
SFA, g	20.91	27	33.46	41	17.18	17	19.96	24
Chol, mg	161.96	383	320.05	454	162.65	240	136.10	275

meats. It is interesting to note that this study's subjects actually consumed more servings of fruits, dairy and other food groups. The large differences for the servings from the other groups is likely due to differences in tallying for this study. The current study totals beverages, other and fat groups to represent the other groups from the FGP. These beverages and other groups include some foods that are not necessarily high in fats or sugars (i.e. black coffee, diet pop, condiments), and EAT II is referring specifically to fats, oils and sweets. Caffeinated beverages in the form of pop/soda and coffee/tea were the major contributors to servings in the beverage group, while sugar and condiments were the major contributors to the other groups. Of those foods (animal fats, vegetable fats, salad dressings, gravies/fat-based sauces) listed to contribute to the fat group for the current study, only gravies/fat-based sauces played a minor role. Low grain intake persisted into the age-gender data.

Nutrient Intake

Elderly females met the U.S. Dietary Goals of $\leq$30% of calories from fats, while elderly males were only slightly above this standard. Young males had the least favorable contribution of calories from carbohydrates and fat of these four age-gender groups. All age-gender groups had sugar intake in excess of 10% of the total calories (elderly males - 23%, elderly females - 26%, young males - 24%, young females - 21%). Although all age-gender groups did not have the recommended percentages of calories from each SFA, PUFA and MUFA to decrease risk for disease, both elderly males and females were closer to those percentages (elderly males - 10.9% SFA, 6.3% PUFA and 12.2% MUFA; elderly females - 10.5% SFA, 6.4% PUFA and 11.7% MUFA; young males - 13.2% SFA, 5.2% PUFA and 12.8% MUFA; young females - 12.1% SFA, 6.2% PUFA and 11.9% MUFA). Young males were the only group that exceeded 300 mg of dietary cholesterol per day. Elderly males and females may have made conscious efforts to have more fiber in their diet, but the effect of the Congregate Meals should be considered.

Many of the differences in vitamin and mineral intake appear to be driven by young males (consuming higher amounts) while young females driving others (consuming lower amounts) (see Table 4.41 and 4.42). The calcium to phosphorus ratio for all age-gender was low (elderly males - 0.68:1.00,

elderly females - 0.75:1.00, young males - 0.75:1.00, young females - 0.69:1.00). Elderly males and females both had a more appropriate sodium to potassium ratio (elderly males - 1.21:1.00, elderly females 1.31:1.00) than the young males and females (young males - 0.75:1.00, young females - 0.69:1.00). The ratios of calcium to phosphorus for both age groups and the young subjects' sodium to potassium ratio would not be considered appropriate to decrease risk for disease (Dwyer, et al. 1994).

Tables 5.6 and 5.7 provide some age-gender comparisons from the NHANES II study (NCHS, 1981). The current study's elderly males had similar nutrient intakes for only vitamin C and iron. Elderly females from the current study had similar intake of total fat and SFA, but frequently had higher intake of vitamins and minerals (except vitamin A). Young males from the current study had similar nutrient/nutrient component intakes for percentage of calories from protein and SFA. The current study's young females had similar intake of percentage of calories from protein, thiamin, niacin, calcium, iron and sodium.

For all age-gender groups, nutrient intake appeared to be calorie driven with the exception of vitamin B12 and iodine (young males persisted in having a higher intake). Table 5.7 provides a comparison of calorically based intake of some nutrients/nutrient components of the current study's age-gender groups to NHANES II (NCHS, 1981) data. Although there were some nutrient intakes based on calories that were similar for each age-gender group and a few lower intake values, this study's age-gender groups appeared to have a more nutrient dense diet overall than the subjects from the NHANES II study (NCHS, 1981).

The USDHHS (1990) has provided information that only 7% of females and 14% of males ages 19-24 consume three or more calcium rich servings of foods per day. Young males appeared to make selections of calcium rich foods. However, elderly females and young females failed to have intakes that are recommended by NIH (1994) (1200-1500 mg/day young adults, 1500 mg/day for all women over 65 years of age). These are important considerations for prevention of osteoporosis development and/or progression.

There were several statistically significant differences in percentages of subjects that consumed 67% or more of the RDA/ESADDI between this study's age-gender groups, with young females

TABLE 5.6
MICRONUTRIENT INTAKES BY AGE-GENDER - A COMPARISON OF STUDIES

	Current Study Eld Males	NHANES II 76-80 Eld Males	Current Study Yng Males	NHANES II 76-80 Yng Males	Current Study Eld Females	NHANES II 76-80 Eld Females	Current Study Yng Females	NHANES II 76-80 Yng Females
Nia, mg	18.81	20	24.03	29	17.92	15	16.24	16
Ribo, mg	1.96	1.8	2.88	2.4	1.70	1.4	1.42	1.5
Thia, mg	1.62	1.3	1.62	1.7	1.60	1.0	1.09	1.1
Vit A, RE	1296.79	1978.38	1282.31	1745.35	1365.29	1669.37	645.88	1412.91
Vit C, mg	102.94	100	114.91	107	144.55	106	62.17	91
Ca, mg	835.95	698	1019.20	978	851.73	543	642.22	631
Fe, mg	15.14	14	15.63	17	12.93	10	11.29	11
K, mg	3014.33	2399	2519.48	3210	2868.35	1975	1737.35	2085
Na, mg	2494.48	2872	3380.48	3702	2193.58	1995	2348.83	2392
P, mg	1228.05	1194	1372.78	1783	1128.43	884	936.58	1053

TABLE 5.7
NUTRIENT INTAKE PER 100 KILOCALORIES INTAKES BY AGE-GENDER - A COMPARISON OF STUDIES

	Current Study Eld Males	NHANES II 76-80 Eld Males	Current Study Yng Males	NHANES II 76-80 Yng Males	Current Study Eld Females	NHANES II 76-80 Eld Females	Current Study Yng Females	NHANES II 76-80 Yng Females
Kcal	1731	1818	2292	2746	1475	1301	1484	1633
Pro, g	3.95	4.1	3.80	4.0	4.39	4.0	3.72	4.0
CHO, g	13.76	11.2	12.48	10.7	13.39	12.3	12.82	11.4
Tot Fat, g	3.6	4.1	3.9	4.0	3.5	3.8	3.8	4.0
SFA, g	1.2	1.4	1.5	1.5	1.2	1.3	1.3	1.4
Chol, mg	9.4	22.2	14.0	17.0	11.0	19.2	9.2	17.2
Nia, mg	1.11	1.1	1.08	1.1	1.23	1.2	1.10	1.1
Ribo, mg	0.12	0.10	0.12	0.09	0.12	0.11	0.10	0.09
Thia, mg	0.10	0.07	0.07	0.06	0.11	0.08	0.08	0.07
Vit A, RE	74.15	113.7	56.07	65.8	92.59	136.9	46.24	91.8
Vit C, mg	5.94	5.9	5.01	4.2	9.80	8.6	4.19	5.9
Ca, mg	47.87	39.0	44.08	35.8	56.13	42.5	43.30	39.0
Fe, mg	0.89	0.8	0.69	0.6	0.88	0.8	0.77	0.7
K, mg	171.64	134.9	107.93	120.0	194.46	156.9	120.52	133.7
Na, mg	145.51	162.6	155.23	137.1	148.98	158.0	161.97	153.6
P, mg	70.46	66.5	59.00	65.2	76.25	69.6	63.39	65.6

generally driving these differences (lower percentage of subjects). More than or equal to 90% of elderly males were able to attain the 67% level for six vitamins and five minerals, while more than or equal to 90 % of the elderly females attained this standard for eight vitamins and six minerals. More than or equal to 90% of young males were able to attain the 67% level for five vitamins and four minerals, while more than or equal to 90% of the young females attained this standard for only one vitamin and one minerals. Sodium is represented in each groups' mineral information. This information of percentage of young females that consumed at least the standard of 67% or more of the RDA/ESADDI is dismal - many of these young females from this study appeared to have a diet that was inadequate in vitamins and minerals.

Regarding the specific intake compared to the RDA/ESADDI, different patterns of nutrients and nutrient components that may be considered at risk for all age-gender groups existed. The base of mean intake of nutrients at risk was the same for all four groups - biotin, copper, molybdenum and chromium. Fiber was at risk for elderly females, young males and young females. Elderly males and young females also had mean intakes of zinc and iodine that put these nutrients in the at risk category. Both young males and young females extended this list of at risk intakes for vitamin D, vitamin E and vitamin K. Young females also were at risk for calcium, pantothenic acid, manganese and chloride.

Summary for Age-Gender

Few differences in food groups intake existed between elderly males, elderly females, young males and young females. Many differences did exist for mean intake of nutrients/nutrient components (generally young male driven for higher intake or young female driven for lower intake), however when mean intake was based on calorie intake many of these differences did not persist. Young females usually were the driving age-gender group for differences in percentages (young females had lower percentages) of those subjects that met $\geq$67% of the RDA/ESADDI. Minerals appeared to be more at risk for all age-gender groups than vitamins.

Considerations Regarding Results

1. Several important factors should be considered when reviewing the data and discussing the results. It is always questionable whether recordkeeping has been accurate or not. An example is the low recording of alcohol intake by all young subjects or omittance of water consumption, both of which could be different than actual intake. Initial "training" of subjects for record keeping and the committment of the subjects has much influence for gathering accurate intake data. To further assist with establishing accuracy of intake (i.e. calories), accurate activity records, attitudes toward weight, dieting behavior, family history, food beliefs and weight/weight changes for all age groups would have been beneficial. Analyzing blood and urine labs can increase the ability to gage accuracy of various nutrients consumed (i.e. sodium), but due to cost it is frequently not plausible to run these labs.

2. At least three days of food records have been indicated as being adequate to represent the "usual" diet of groups, and the gathering of sets of dietary records (i.e. two sets of 3-day records) can usually overcome seasonal or other variations to help provide information that is more representative of "usual" diet (Thompson, et al., 1994; Basiotis, et al., 1987). Although both age groups provided at least 3-day records, only the elderly subjects provided two sets of 3-day records. Therefore, is must be questioned if both age groups had dietary records that were representative of "usual" diet regarding seasonal variations.

3. Values of nutrient intake as a result of nutrient analysis are always an issue for research. For example, the Food Processor 6.0 provided data that showed intakes of Niacin equivalents were less that Niacin. This is confusing as niacin equivalents should represent the actual niacin content of a food as well as the niacin precursor tryptophan content of a food.

The nutrient analysis data also can skew data as a result of missing values in a data base. A review of the analyses provided by Food Processor 6.0 resulted in the following information:

Percent of Subject Days with a
"No Value" in Data

	Elderly	Young
Biotin	4.3%	0%
Boron	25.0%	1.7%
Chloride	11.7%	0.4%
Chromium	72.6%	42.7%
Copper	0.8%	0%
Fluoride	100%	100%
Iodine	11.7%	0.9%
Molybdenum	14.5%	2.1%
Vitamin K	12.5%	0.4%

These difference in percentages representing "no values" in nutrient data exemplify the differences in foods selected by each age group. These percentages represent the subject days with no values. The values analyzed by the Food processor 6.0 (ESHA, 1994) represent known values for this data base. In those remaining percentages for the above nutrients as well as other nutrients, there are still foods with missing values. The data from this study indicate that biotin, chromium copper and molybdenum were nutrients at risk for age, gender and age-gender. However, the actual levels of intake for these nutrients could be higher due to missing values.

Review of the Objectives

The objectives of this study were to evaluate dietary records of young and elderly adults to determine relationships among food choices and nutrient adequacy. Associations between food choices and physical measures (when available) were also evaluated. The specific objectives were as follows:

1) Evaluate food selection/patterning to assess the relationships between food choices and dietary patterns.

2) Determine the nutrient intake specific for each group (age, gender and age-gender) and determine the adequacy of the intake.

3) Determine relationships between food group patterns to blood chemistries in the elderly group and anthropometries in the young adult group.

Review and Discussion of Hypotheses

The hypotheses stated:

1) There would be no significant differences between food choice patterns between males and females, elderly adults and young adults, or any age-gender groups.

2) There would be no significant difference in nutrient intake between males and females, elderly adults and young adults, or any age-gender groups.

3) There would be no relationship of physical markers and food groups intake.

After a review of the data/results, it can be seen that it is appropriate to reject these three hypotheses. Several differences in food choice patterns were identified. Differences in nutrient intake were also identified, however, for gender these differences ceased to exist when nutrient intake was based on calories. For age-gender, the differences in nutrient intake, with the exception of one vitamin and one mineral, also no longer existed. Relationships of various food groups to physical markers existed (total serum cholesterol, height, weight, ideal body weight, percent ideal body weight and body mass index).

General Summary

These groups of subjects clearly had differences in intake of various food groups and nutrients. Calorie intake appeared to be an indicator of nutrient intake. Age of subjects was a strong driving force for differences; elderly subjects appeared to make better, more nutrient dense selections of foods. However, all groups were still unable to make food selections that align with the guidelines of the FGP.

This study has provided information on the selection of foods and nutrient intake for a specific population of ages and gender. These subjects studied had overall intake similar to populations that have been previously studied. These groups consumed inadequate amounts of whole grains, vegetables and fruit (fruit exception - elderly); Patterson and Block (1988) have indicated that this is typical of the U.S. diet. Mineral intake was more at risk than vitamin intake. Nordstrom (1982) indicates that this is typical for many older adults. Sugar intake was high for all - gender, age and age-gender - groups, and this is similar to what Fanelli and Stevenhagen (1985) found. Haines, et al. (1992) provided

information that location of food intake was important for nutrient intake. This study did not provide detailed information on location of meals, but the elderly generally were taking part in Congregate meals, and elderly did have a better nutrient intake.

Future Indications for Research

There is yet much to be learned about nutrition and eating behavior. Researching food group selections and nutrient intake is important for increasing the knowledge base regarding nutrition, which in turn affects health promotion, wellness and education. Understanding eating behavior and nutritional status is an important component of nutrition research, especially to help identify the optimal diet for not only healthy individuals but also for those individuals that have any disease condition. Being able to accurately establish dietary intake for the population being studied is important. Errors in reporting and variation in intake make it difficult to provide any associations between intakes and disease incidence (el Lozy, 1983), while some nutrients require many days to estimate what an individual's mean intake is (Basiotis, et al., 1987). There is much data lacking for various special populations (i.e. elderly, ethnic/racial groups, those with disease conditions) and several nutrients (i.e. missing data on nutient content in foods) that have a direct effect upon nutrition professionals' ability to assist with health promotion and wellness for populations. As more information is learned about eating behavior, including patterns of selection, and nutrient intake, better education can be provided for both health care professionals and the public.

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VITA

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Candidate for the Degree of

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Biographical:

Education: Graduated from Shidler High School, Shidler, Oklahoma, in May, 1977. Received Bachelor of Science degree in Animal Science-Business from Oklahoma State University, Stillwater, Oklahoma, in December, 1983. Attended Oklahoma City University to study Law. Attended University of Oklahoma (Norman, Oklahoma) and University of Oklahoma Health Sciences Center (Oklahoma City, Oklahoma) for coursework applying to Master's degree. Attended Oklahoma State University to complete prerequisites for entering AP4 Program. Completed AP4 Program at Oklahoma State University in May, 1991. Completed the requirements for the Master of Science degree in Nutritional Sciences at Oklahoma State University in July, 1996.

Experience: Financial and legal experience from working as administrative assistant with employee benefit trust and assistant in legal offices. Dietitian with experience in the areas of clinical, community education and consulting. From June, 1995 to current - experience includes providing national training and technical assistance for Title VI programs, including national T/TA newsletter, reservation T/TA, cluster T/TA and national conference organization and T/TA.

Professional Memberships/Licensing: Registered Dietitian. Licensed Dietitian in the State of Oklahoma. Oklahoma Dietetics Association. American Dietetics Association, including Gerontological dietetics practice group. Previous member American Society of Parenteral and Enteral Nutrition and Oklahoma Society of Parenteral and Enteral Nutrition (President-Elect).

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Proposal Title: Effects of Dietary Fiber, Fat and Calcium on Body Composition

Principal Investigator: Christa F. Hanson

Date: 6-30-92 IRB # HE-92-070

This application has been reviewed by the IRB and

Processed as: Exempt [XX] Expedite [ ] Full Board Review [ ]

Renewal or Continuation [ ]

Approval Status Recommended by Reviewer(s):

Approved [XX] Deferred for Revision [ ]

Approved with Provision [ ] Disapproved [ ]

Approval status subject to review by full Institutional Review Board at next meeting, 2nd and 4th Thursday of each month.

Comments, Modifications/Conditions for Approval or Reason for Deferral or Disapproval:

Signature: Marcia K. Tilley Date: 7-1-92

Chair of Institutional Review Board