NUTRITIONAL ADEQUACY OF THE DIET IN RELATION TO NUTRITION KNOWLEDGE AND TO SELECTED SOCIO-ECONOMIC AND DEMOGRAPHIC VARIABLES OF THE ELDERLY ATTENDING THE STILLWATER CONGREGATE MEAL SITE

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CHAPTER I

INTRODUCTION

The American Dietetic Association's Position Paper on Nutrition and Aging (2, p. 488) indicates that "counseling and teaching both individuals and groups of senior citizens in their homes and in institutions, in the importance and need for eating good food and an adequate diet," is essential for improvement of the health and nutritional status of the ever growing senior citizen population. Nutrition education is a vitally important basis for improvement of the older adults' diet through the presentation of current knowledge regarding selection, storage, and preparation of food (2).

Equally important to the older adult is educational material related to the importance of good dietary habits in alleviation or prevention of disease in later years. Nutrition education programs and materials for the elderly should be formulated with their needs and desires in mind and in respect to elderly food intake patterns and overall knowledge of nutrition. A thorough study of the aging process and demographic and socioeconomic variables related to aging can provide a foundation for development of educational food programs for the elderly.

Aging is an on-going process initiated at conception that requires optimal nutritional care with particular emphasis placed on those members of society 65 years or older (27). By the year 2000,

life expectancy for individuals 65 and over will increase by five years, while the entire over 65 year old population will increase dramatically until the year 2020 (20). At the onset of the twenty-first century, it is estimated that approximately 31 million people will be older than 65, or one in every five persons will have attained 65 years of age (55).

With older adults comprising an ever increasing segment of the population, the influences of selected variables on the nutritional intake of the elderly should be analyzed. In 1968, Title IV of the Older American Act indicated that

> . . . elderly persons do not eat adequately because: (1) they cannot afford to do so; (2) they lack the skills to select and prepare nourishing and well balanced meals; (3) they have limited mobility which may impair their capacity to shop and cook for themselves; and (4) they have feelings of rejection and loneliness which obliterates the incentive necessary to prepare and eat a meal alone. These and other physiological, social, and economic changes that occur with aging result in a pattern of living, which causes malnutrition and further physical and mental deterioration (1, p. 1).

In addition, established habits of eating are often ingrained and difficult to break in the elderly and may be a significant deterrent to optimum nutrition. Sociological and environmental backgrounds greatly influence food intake patterns and cannot be forcibly changed without a thorough understanding of why individuals eat as they do. A gradual modification of dietary intake through nutrition education programs can cause improvement in food habits. The elderly need aid in solidifying important nutritional concepts to meet their changing bodily requirements, through better menu planning as well as optimal food purchasing, preparation, and storage techniques (13). Therefore, it is essential that nutrition education programs be developed for the

elderly to help focus on meeting their food and nutritional needs, thus improving their health, well-being, and sense of independence through improvement of nutritional status (2). Little is known about present nutritional knowledge and food habits of the elderly aged 65 and older. Therefore, there is a need to study what the elderly know about nutrition and what they are consuming as related to variables including age, sex, income sources, education, living conditions, and nutrition knowledge. Results of the study will become a basis for development of nutrition education materials and programs for the elderly participating in nutrition programs.

Purpose and Objectives

The purpose of this study was to determine the nutritional adequacy of the diet in relation to nutrition knowledge and to selected socioeconomic and demographic variables of the elderly participants in the Payne County Elderly Nutrition Center, Stillwater, Oklahoma. The objectives of this study were as follows:

1. To assess nutritional adequacy of the diet in accordance with the 1980 Recommended Dietary Allowance.
2. To determine the difference between selected nutrient intake and age, sex, income sources, education, living conditions, and nutrition knowledge of the subjects.
3. To assess responses to nutrition and social services provided by the Payne County Elderly Nutrition Program.
4. To make suggestions and recommendations for nutrition education programs and materials for elderly nutrition programs.

Hypothesis

The following hypothesis was postulated for the research study:

H_1: Dietary adequacy of food intake will not be significantly different according to age, sex, income sources, education, living conditions, and nutrition knowledge of elderly adults.

Assumptions and Limitations

This study was conducted on the basis of the following underlying assumptions:

1. Inadequate diets are often found in the elderly segment of the population.

2. It is possible to modify the eating habits of elderly adults through well planned nutrition education programs.

3. Variables including age, sex, living conditions, income sources, education, and nutrition knowledge may affect nutritional adequacy of diets within the elderly population.

The following limitations were present in this study:

1. This study was limited to a select population of elderly adults at the Stillwater site of the Payne County Elderly Nutrition Program willing to participate in two interviews.

2. Food intake data information was limited by usage of the 24-hour recall method of dietary survey.

Definitions

The following terms were defined for this study after a review of the literature:

Nutrition Education - Purposeful self-improvement involving some form of foods and nutrition learning for self or family through the use of carefully designed instructional aids and programs related to nutrition (41).

Nutrition Education Programs - Aid in transmission of nutritional information as well as changing dietary patterns through the use of nutritional materials designed to meet a variety of needs based on current nutritional concepts and instructional aids (36).

Nutrition Materials - Instrumental and/or expressive activities designed to aid in nutrition education programs through active and passive learning of nutritional concepts (35).

Nutritionally Adequate Diet - Based upon 75 percent of the Recommended Dietary Allowances of nutrients developed by the Food and Nutrition Board of the National Research Council, and "furnishes the body with all the nutrients necessary for the growth and repair of tissues and the normal functioning of the organs" as related to age and sex (17, p. 3).

24-Hour Recall - Method of obtaining information concerning food and beverages consumed within the past 24 hours. They are conducted by trained interviewers and the "subject is often given food models, measuring cups, or a ruler to help him describe the amounts of food consumed" (13, p. 348).

Analysis of Variance -

> This method will permit us to compare any number (k) of samples at the same time and to decide whether they came from populations identical in their means. The AOV is a remarkably versatile technique for drawing inferences about the differences between population and the factors producing those differences (21, p. 455).

Frequency Distribution - "Counting the number of cases in each class interval gives us a simple frequency distribution" (21, p. 57).

Duncan's Multiple Range Test - Involves using

> a different range value for subsets of different sizes. (The larger the potential subset, the larger the difference in means must be in order to be declared significant.) The Duncan procedure also uses the concept of a special protection level rather than a significance level: the probability of finding a significant difference, given that the two groups are in fact equal, is less than or equal to the specific significance level. Duncan may be used whether or not the analysis of variance is significant (22, p. 428).

Social Security Income - The most widely used form of retirement income, covering most forms of employment with the exception of the federal government. If eligible, monthly checks may be collected at age 62 and older; under age 65, checks may be collected if the individual is severely disabled (55).

Welfare - "A state in which the welfare of its citizens is promoted largely by the organized efforts of the government rather than by private institutions" (51, p. 1658).

CHAPTER II

REVIEW OF LITERATURE

The elderly segment of the population is a group nutritionally at risk. This fact stems from several reasons: 1) altered or decreased nutritional intake, 2) altered nutritional requirements, and 3) impaired nutrient absorption (45). Physiological aspects of aging vary among people; yet specific bodily changes are inevitable as aging progresses. Nutritional status studies (10, 38, 40) indicate that the elderly are a nutritionally vulnerable group, generally deficient in many of the nutrient intakes for individuals aged 65 and older as indicated by the Recommended Dietary Allowances. Specific demographic and personal variables including age, sex, income, educational background, living conditions, and lack of nutrition knowledge may lead directly to nutritional deprivation in the aged (35). Nutrition education programs can be important in aiding the elderly to change poor eating habits and may assist further development of existing nutritionally adequate food consumption patterns. Consequently, individuals over 65 years of age may enjoy a healthy and active life for their remaining years with proper understanding of bodily function and adequate nutrition.

Theories of Aging

There are numerous theories on the causes of aging. Generally it

is assumed that the process of aging results from a number of mechanisms that operate simultaneously in an individual. One such theory of aging suggests that the DNA structure within a cell is disrupted, resulting in faulty DNA replication. This in turn may cause bodily production of defective protein molecules, considered essential for normal bodily function (18).

A second theory of aging postulates that antibody production within the body becomes defective. This faulty production causes the body to develop autoimmune reactions, in addition to the normal function of combating foreign substances (53). Cell destruction or mutation may then occur.

A final acceptable theory of aging, known as the intermolecular theory of aging, states that abnormally large protein aggregates accumulate within the cells. Such action disallows normal function and causes subsequent cell destruction (32).

Regardless of which of these theories of aging or a multitude of less prevalent philosophies is most acceptable, the renal, gastrointestinal and neuromuscular systems are most commonly influenced by cell aging. Consequently, the nutritional status of the older adult is affected (53). Throughout the aging process, the percent of nephrons in the kidney gradually diminishes resulting in an increased insufficiency of kidney function (53). Renal function, including glomerular filtration rate, renal blood flow, and production of urine has been shown to decline six tenths of a percent per year in an adult (53). The aging process in general is reflected by the fact that

> . . . the overwhelming majority of elderly people have one or more chronic illnesses, such as atherosclerosis, digestive upsets including malabsorptive phenomena,

> rheumatologic disorders, osteoporosis, obesity, alcohol addiction, lack of teeth or poorly fitting dentures, and a whole host of other medical and physiologic problems (18, p. 67).

Aging is often accompanied by an increased rate of obesity within the elderly population due to hyperplasic increases and loss of lean body mass late in life (5, 14, 33, 37, 38). Impairment of motor function within the population increases with age. Muscle contractions decrease in efficiency due to a decrease in functioning muscle fibers with overall weakness (53).

Loss of bone density and strength occurs frequently within the elderly population. Some researchers indicate that calcium deficiencies throughout life results in osteoporosis and peridontal disease (14, 53).

Gastrointestinal Function

Gastrointestinal function decreases dramatically during the aging process, in many cases resulting in decreased nutrient absorption. The salivary glands produce decreased amounts of saliva, resulting in increased difficulty with mastication and the subsequent swallowing function (43). Taste diminishes concurrently with increased age, often causing the older adult to derive less pleasure from meals, thereby decreasing consumption. In the United States, 43 percent of the people over age 60 have lost a majority of their teeth, sometimes resulting in a limited diet (43). Hydrochloric acid secretion and calcium absorption decreases after age 65 as does the level of secretion in various other digestive organs. Peristaltic motion of the intestine is also reduced in many instances, promoting constipation in the elderly (43).

Neuromuscular Function

Neuromuscular variations in the elderly may be represented in a multitude of ways, including overall body weakness. A decline in lean body mass with an increase in adipocyte number in the elderly may result. Bone loss due to calcium resorption results in easily broken, frail skeletal structures (42, 53). Men and women alike experience bone loss after 50 years of age; frequently, this occurs twice as often in women (53). Studies indicate that a correlation between loss of teeth and osteoporosis has been shown (18). By 80 years of age, it has been estimated that one-half of all muscle cells have been replaced by fat and fibrous connective tissue (5). Central nervous system deterioration is evidenced, in part due to changes in the amount of blood reaching the brain (32). Reflex actions are often considerably slower than those observed in a younger individual, as characterized by a sense of imbalance as well as an impaired response time, loss of memory, and increased sensitivity to lifestyle or personal change (32).

Recommended Dietary Allowances

The Recommended Dietary Allowances (RDA) have been in existence since 1940 when they were developed by the Food and Nutrition Board of the National Academy of Sciences (46). Since then, the RDA has served as a basis for evaluating nutritionally adequate diets for healthy individuals. The recommended amounts of nutrients varies according to age and sex, and must be modified according to personal variables, including physical activity, variations within the

population, and factors within the environment. According to Todhunter:

> . . . it must be remembered that the Recommended Dietary Allowances are intended as nutritional allowances for groups of healthy people and should not be used to evaluate individual diets; nevertheless, the RDA's are a useful goal for planning meals of elderly individuals (46, p. 1).

Studies have been conducted concerning nutritional adequacy of the diet of older Americans based upon relative dietary needs suggested by the Recommended Dietary Allowances (10, 22, 28, 29, 35, 44). Difficulties arise because of a lack of willingness on the part of elderly individuals to participate in nutritional status studies (13), resulting in sample populations not necessarily representative of entire populations.

Nutritional Status Studies of the Elderly

Eight hundred and ninety-five individuals were studied in the Ten-State Nutrition Survey (44, 50) from 1968 to 1970 to determine nutritional adequacy of the diet using 24-hour recalls and food frequency charts. For those individuals aged 65 and older, caloric consumption was low in males and females studied, while iron levels in black females, low income whites, and high income Spanish-American females was similarly low. Levels of protein within the diet were low for black males and white females, as well as high income Spanish-American females. Calcium levels in one-half of the women from high income areas and one-third of the women from low income levels were also below the Recommended Dietary Allowance. Ascorbic acid was also below the Recommended Dietary Allowance for one-third of the subjects studied.

The HANES study (13), conducted in 1971 and 1972, evaluated the nutritional intake of 1515 individuals over age 60. Results determined that approximately one-half of the subjects surveyed obtained less than two-thirds of the RDA for calories, calcium, and vitamin A. Twenty percent of the sample population consumed less than two-thirds of the RDA for iron and vitamin C. Less than two-thirds of the RDA for protein was consumed by 15 percent of the individuals studied.

In 1963, Fry, Fox, and Linkswiler (10) studied a group of 32 elderly women over age 65 to determine nutritive intakes of single women living alone. Weighed food intakes and seven day consecutive food records were used to obtain data. Results indicated that the mean daily intake of the population studied exceeded two-thirds of the RDA, except in the cases of iron, calcium, and vitamin A which were consumed at levels less than the RDA in 12 percent, 16 percent, and 9 percent of the women studied, respectively.

In 1964, Swanson (42) conducted a study comparing nutritional adequacy of the diet of women over age 70 with women aged 30 to 39 in Iowa. The total sample population studied consisted of 1072 individuals from throughout the state. Results indicated that the older women decreased their intake of vitamin C, calcium, calories, and protein as age increased. As caloric consumption decreased, the carbohydrate intake in the diet remained constant.

O'Hanlon and Kohrs (23) conducted research concerning summaries of several dietary studies which used food records, 24-hour recalls, and dietary histories in 1978 to assess nutrient intakes of older Americans. The compiled data obtained from these studies revealed that individuals over age 59 were most often found to be deficient

in calcium and energy. Diets of the subjects studied were most often found to be nutritionally adequate in niacin and protein.

In 1965, Steinkamp, Cohen, and Walsh (40) studied a group of 577 elderly individuals covering a 14 year time period. Results from this research indicated that vitamin C was deficient in both men and women studied, while calcium was found to be deficient in women and deficiencies in caloric consumption were apparent in men. All nutrients studied decreased with age, with a sudden drop in nutritional adequacy after age 75. Caloric consumption decreased in relation to a lessened consumption of total intake, as opposed to decreases in specific food groups.

Kohrs, O'Hanlon, and Eklund (16) conducted a nutritional survey of Missouri Congregate Meal sites in 1978, to determine nutritional adequacy of the diet of Title VII congregate meal participants, compared to non-participants. Two-day food records were used to collect information from the 466 subjects in the sample population, concerning food and beverage consumption. Results indicated that participants in the congregate meal programs generally consumed more nutritionally adequate diets than non-participants. Women participants consumed significantly more of the RDA for the majority of nutrients studied, compared to the men studied. Of the total daily intake of participants, 40 percent to 50 percent of the Recommended Dietary Allowance was provided at the meal site in the noon meal.

Nutritional Requirements of the Elderly

Contrary to popular belief, the elderly individual requires levels of nutrients within the diet which probably are not essentially

different from those in early maturity (42). Requirements for caloric intake, however, decrease with age because of changes in basal metabolic rate, loss of functioning protoplasm, and decreased physical activity (33, 42, 46). Nutrient density of foods should be considered in the diet of the elderly, because calorically dense foods without sufficient nutrients may lead to a malnourished, yet obese in individual. According to Krehl:

> . . . the problem of obesity substantially increases the difficulties of osteoporosis and rheumatic increases, which are commonly found in the elderly. Here again, excessive use of carbohydrate with a concommitmant low intake of protein, may be a contributing factor in the problem (18, p. 71).

Desirable levels of protein required within the diet of the elderly population have not been fully determined (45). Protein is an essential constituent of the diet (45, 46) with a number of specific purposes, including enzymatic reactions important to cell life and protoplasmic renewal (42). High levels of ingested protein may result in overburdening of the normal kidney function, which is required in nitrogen by-product excretion (46). According to Todhunter (46, p. 3), "periods of emotional stress have been shown to cause negative nitrogen balance in some elderly women."

Calcium is generally found to be consumed by the elderly in amounts less than the RDA (42), contributing to the incidence of osteoporosis in the aged (42, 46). Bone structure is determined by the constantly dynamic rate of calcium metabolism. Without sufficient quantities of ingested calcium for use by physiological processes within the body, calcium is resorbed from bones. This resorption causes weakening of bone structure with increased risk of osteoporosis (42). Todhunter (46, p. 2) further suggests that ". . . stress,

emotions, immobility, and high protein intake of some protein sources militate against calcium retention."

According to Guthrie (13, p. 420), ". . . an examination of dietary intakes of older people reveals that vitamin A and ascorbic acid are the nutrients most likely to be lacking." Vitamin A is essential in the diet because of its role in the visual system of the body (11, 13). Without sufficient bodily stores of vitamin A in the liver, which is a frequently occurring incidence in the elderly, rhodopsin formation in the eye decreases. When inadequate levels of vitamin A are ingested over long periods of time, a decreased adaptation to darkness and eventually night blindness, as well as decreases in the sensations of taste and smell may result (13). When taste and smell are affected, the elderly individual may develop an accompanying desire to reduce food consumption. Guthrie (13, p. 216) states that, ". . . many disturbances in the gastrointestinal tract, such as diarrhea, have been linked by various investigators to changes in the epithelial tissue that takes place in the absence of vitamin A." Coupled with increasing gastrointestinal dysfunction associated with the aging process, vitamin A deficiency may be particulary detrimental to the elderly population.

Vitamin C is important in the diet because of its ability to increase nonheme iron absorption and increase healing (46). Adequate amounts of vitamin C are particularly essential for the elderly population in order to increase iron absorption within the body (13). Good sources of vitamin C, such as fruit and vegetables, add bulk to the elderly individual's diet, possibly decreasing incidence of diverticular disease and constipation associated with old age.

If an elderly individual does not consume an adequate intake of iron in the diet over a span of several years, iron deficiency anemia may result (11). The elderly population develops a decreased secretion of hydrochloric acid in the gut as aging progresses, resulting in decreased iron utilization (13). Iron is an essential cell constituent because of the role it plays in oxygen and carbon dioxide transportation during cell respiration, as well as the development of red blood cells (13).

Inadequate levels of thiamin in the diet may result in a depression of the appetite (13). Thiamin acts as a coenzyme in carbohydrate and fat metabolism, and in protein synthesis within the body (13). Insufficient thiamin intake has been shown to affect neurological transmission as well (11, 13). The elderly tend to suffer from decreased neurological responses as aging progresses, decreased desire to eat, and decreased efficiency of metabolic processes, which may be enhanced through thiamin deficiency.

Guthrie (13, p. 263) states that, ". . . riboflavin is a part of several enzymes and coenzymes in which it contributes to their capacity to accept and transfer hydrogen atoms, or positive charges." Animal studies (11) suggest that adequate levels of ingested riboflavin within the diet resulted in skin excema, opthalmia, fatty liver, and in severe cases, death. Since the aging process tends to facilitate changes in skin elasticity as well as sight deterioration, adequate levels of the nutrient in the diet may arrest some of the symptoms noted in riboflavin deficiency.

Niacin is an essential component in the diet for its prevention of pellegra, and the symptoms associated with it, including diarrhea,

dermatitis, and dementia (11, 13). The nervous system and the gastrointestinal tract are severely affected and death eventually results. During the aging process, gastrointestinal and neurological dysfunctions are likely to occur. Niacin deficiencies within the diet tend to enhance the degree of damage; therefore, niacin is an essential dietary component in all population groups, with emphasis on the aged population.

Variables Influencing Nutritional Status

Age

Age plays a vital role in consumption patterns of the elderly. According to Shock (37, p. 491), ". . . the expansion of medical knowledge and improvements in socioeconomic conditions have contributed to increasing the average age of death in the United States." In the 1900's, the mean life span was approximately 47 years, which increased to 67.8 years for men and 75.1 years for females in 1967. During the period between 1900 and 1960, the elderly persons over age 65 quadrupled in the United States. The life expectancy rate is steadily increasing for both men and women, with 72 years being an average expectancy rate today (20). Currently, one in every 16 elderly people is over 85 years old; by the year 2035, one in ten senior citizens will be 85 or older (9). One-half as many men compared to women are present in the population by age 85 (46). In part, this is due to the medical advances made in recent years to decrease both infant and maternal mortality, and to the vast number of diseases for which cures have been or are in the process of being developed (9). Consequently,

the ever increasing age of the population necessitates an increase in nutritional knowledge and application for optimal health.

Sex

Statistically, the older population consists of a majority of women in comparison with men (9). Advancements in the field of medicine have helped women to increase life expectancy rates at a greater proportion than men, due to an increasing knowledge of health factors during the child-bearing years (9). The only seemingly detrimental result of the greater number of women in the population is the increasing number of widows in relation to widowers (47). An unequal distribution of sex results in a substantial number of women living alone due to factors other than the death rate of men. Not only is it easier for a widower to find a new mate because of the greater number of available widows to remarry, but the societal trend facilitates younger women marrying older men (47). Since the percentage of deaths generally increases with advancement in age, widows abound. The elderly widower would tend to be more at risk nutritionally than the widow when isolated in dwellings. Men often do not possess the same experience in menu planning and production as do women, and may desire to do without meals rather than attempt to develop necessary skills to prepare them. Unless elderly individuals are physically and mentally self sufficient, living with relatives or friends may be an advantage, as the possibility of a more well-balanced diet being prepared in a larger household may result.

Income Sources

Income is a deciding factor in nutritional adequacy of the diet in the elderly population, for when money is difficult to come by, the food budget tends to be the first monetary item to be reduced (26). Not only is purchasing a problem when income decreases and cost of living increases, but preparation can be impaired when inexpensive housing containing inadequate kitchen facilities faces those on limited incomes (31). Some forms of transportation, too, may be inaccessible or too costly for the elderly population, resulting in the pyramiding effect of fewer trips to the supermarket and a less nutritionally adequate diet (43). It is, however, a misconception to believe that all older adults are operating below the poverty level. Studies indicate that in 1975, 35 percent of those people over age 65 were, indeed, living on an income standard above poverty, which was defined at $3000 annually (24).

A variety of programs have been established to offer finanical support to those individuals over 65. These programs include Social Security, Supplemental Security Income, Income Retirement Act, Medicare, Medicaid, Food Stamps, and the Elderly Nutrition Program (32). Social Security was developed by the federal government in 1935 to supplement savings which individuals accrued during work for retirement purposes. After extensive revisions over the past several years, the majority of the population over age 65 received approximately $400 each month (32). With the population reaching eligibility rate in increasing numbers, it is evident that the system must be modified by greater employer and employee contributions, if it is to reach everyone eligible in the near future (39).

Supplemental Security Income (SSI) is a program operated by the federal government to aide older individuals with extremely low incomes. All couples over age 65 are able to receive $266.70 each month if eligible (32).

The Income Retirement Act is an additional major aid in assisting the income of older people. Every individual is entitled to place $1500 of nontaxable income into a retirement account each year. Consequently, this system facilitates planned, forced retirement from early in life onward. No taxes are paid upon the accrued savings until benefits from it are reaped during retirement (32).

Medicare and Medicaid, which are both amendments to the Social Security Act in 1965, Food Stamps and the Elderly Nutrition Program are additional programs that greatly improve the nutritional and social status of the elderly. However, all segments of the population do not necessarily qualify when their income level does not fall within the boundaries set by the programs. Those who do qualify enjoy relatively inexpensive food as well as reduced medical and hospitalization rates.

Every age group is affected by problems with income coupled with soaring inflation rates, but individuals on a fixed income tend to suffer most. Consequently, consideration must be made to offer the elderly assistance whenever possible to obtain an optimal standard of life and subsequently, adequate nutrition.

Educational Levels

Educational levels attained by older adults play a significant role in nutritional adequacy of the diet in the elderly population.

According to data collected by Young:

> . . . as income level increased within each of the various educational categories, there was no consistent relationship to the adequate usage of milk, fruits, and vegetables high in ascorbic acid, fruits and vegetables high in carotene, or 'other vegetables.' On the other hand, there was a definite positive relationship between the usage of these important protective foods and educational level (55, p. 510).

Consequently, findings also seem to indicate that lower levels of education tended to result in questionable, often inadequate, dietary habits of the population (12, 34).

Statistics reflect the fact that the average level of population achieving higher levels of education has increased. For people aged 25 and older, the median level of education has risen from 8.6 years in 1940 to 12.4 years in 1976 (9). Older adults who received their education during or before the Depression of the 1930's generally average eight years of formal education or less (9). It is predicted that by the year 1990, 12 years of education will be the average number attained by most older adults (9).

Associated with the increasing higher levels of education is the increase in professional occupations with paralleled earning increases (9). With the predicted proportional decrease in blue collar labor, advancement in income brackets, and higher educational attainment among the older population, an increase in nutrition awareness may also be observed in the future.

Living Conditions

Housing may be a serious problem for older adults existing on a limited income, and may increase nutritional inadequacy of the diet (31, 32). In addition, 33 percent of the elderly live in rural

settings while the remaining 66 percent live in cities or metropolitan areas where low cost, accessible housing is difficult to locate (46). Sixty-six percent of the elderly own their own homes. Thirty-three percent, however, must vie with younger people for rental properties (32). This competition for housing forces those on fixed incomes to assume lower cost, substandard housing in a majority of instances.

An additional living condition commonly found in elderly individuals is the rapid increase of those living alone, as evidenced when ". . . the trend toward living alone has been particularly noticeable among elderly men and women and the oldest subgroups of the elderly population" (9, p. 8). When compared with the increasing elderly component of the population, the actual number of people living alone has increased at a rate three times greater than expected. For example, in 1960, 3.8 million people in the older age bracket lived alone, while in 1976 seven and 0.9 million lived by themselves, which is a 56 percent increase (9). Predictably, the age group over 77 years, with women in particular, are most prone to living alone in single dwellings (9). As mentioned earlier, this is reflectable by the mortality rate in men being established at a younger rate than women. Women comprise a greater segment of the population, and subsequently are forced to live alone more frequently.

A variety of other factors influence the older person's decision to live alone. Geographic diversity of living, without family units due to increased lifestyle mobility, is a major reason for an older individual's solidarity. Supplemental income plans and health care programs have increased dramatically, facilitating a sense of financial independence and security in the elderly. Finally, a decrease in

family size after World War II, reflected in fewer children in today's generation of elderly, may result in fewer family members to live with. Living alone becomes the sole viable option (9). Predictions of the future as reflected by current living styles indicate that ". . . it appears that the number of elderly living alone will continue to climb (9, p. 10). Therefore, congregate meal sites and nutrition education offered at these sites not only provide isolated individuals with a nutritious noon meal from which to pattern their own eating habits, but also facilitates a social atmosphere designed to alleviate any sense of loneliness.

Methods for Conducting Dietary Surveys

"Recommendations for the dietary management of elderly individuals must arise from knowledge of the food habits and nutritional status of the population" (38, p. 464). Several methods of conducting dietary surveys, including the 24-hour recall, food record, and dietary history, may be reviewed to determine the attributes and shortcomings of each method. From this study of dietary survey methods, accurate dietary information of the population may be studied through usage of applicable methodology. The dietary method best used with an elderly population, however, has not been determined (23).

According to Guthrie:

> The 24-hour recall is considered a feasible method of obtaining data that can be used to compare the nutritive intake of groups of individuals. . . . Since it is a retrospective account taken at an unannounced time, it reduces the possibility of the subject modifying his food habits during a time when he knows they are being assessed. The use of the immediately past 24 hours does not involve an appreciable memory span, thus increasing the likelihood of obtaining a complete record (13, p. 348).

The 24-hour recall is an expedient, efficient method of obtaining dietary information (3, 23, 54). When time periods for gathering information are limited, or cooperation of participants is minimal, the 24-hour recall is an appropriate method of conduction of a dietary survey (55). The elderly are apt to suffer from short attention spans, poor reading skills, and impaired vision (18, 35, 37). For these reasons, a 24-hour recall is well suited to the needs of the elderly.

In cases where mean intake patterns of groups are being studied, the 24-hour recall may be used as a substitute for the food intake record. To do this would result in less time required for collection, calculation, and analyzation of data (55).

The 24-hour recall does not provide characteristic information concerning long term food consumption patterns of population studied, nor does it necessarily reflect biochemical or physical findings within the sample population (3). However, when the number of 24-hour recalls is increased within a given group, the accuracy of the collected data improves considerably.

The dietary history is a method of obtaining nutritional intake designed to give an overview of dietary habits for a lengthy span of time (55). Histories may be self administered or solicited by a trained professional or nutritionist to elicit accurate information. The latter method of collection provides the most accurate data. However, a self administered history may be reviewed by a nutritionist with the subject, facilitating more accurate information than that which is provided by the subject alone (4).

Several limitations become apparent when viewing the dietary history method of data collection (4). Many times subjects are not aware of the importance of reporting food intake accurately. Subjects should have the mental capacity to answer questions concerning portion size, methods of preparation, and items consumed, both accurately and precisely. Memory spans are limited within any population after six months to one year (4). Diet histories of duration exceeding this amount of time must be viewed carefully, for information contained within them may be somewhat less accurate than histories obtained for shorter periods (4, 23). O'Hanlon:

> . . . dietary histories based on food frequencies differ from diet recalls in that questions are asked about the general food patterns and habits for a period of time. . . . Advantages of this method are that it does not change normal diet and takes into account seasonal variations in food intake . . . and tend to overestimate amounts of protein consumed (23, p. 1258).

The food record, usually kept for a time period of seven days, requires that the subject maintain a written record of all food and beverages consumed for the designated time period. If the subject is aware of the importance of estimation of accurate portion size and recording of all consumables, this method of dietary survey is highly accurate. Problems may arise if the subject modifies intake levels to facilitate ease in recording data.

When comparing dietary studies using mailed questionnaires or dietary interviews to obtain information concerning nutritional adequacy of the diet, the interview format appears to be best suited to the needs of the elderly population. Rationale for this stems from the fact that the questionnaire "might prove difficult and time consuming for the persons unaccustomed to filling out forms" (48, p. 674).

This may be coupled with the fact that the elderly can be limited in reading and writing skills due to educational and physical impairments, as well as having possible difficulty concerning question interpretation on written forms. An interview format allows the older adult to ask questions of the interviewer when necessary and consequently allows more accurate responses when elicited on a one-to-one basis.

Each type of dietary survey has decided limitations (3). Young (55) conducted a study comparing the 24-hour recall, dietary history, and food record. Results of the study showed that the 24-hour recall did not obtain the same results for individuals as the dietary history or as the food record when interviewing grade school children, high school and college students, and pregnant women. When the same groups were studied for mean intake using nutritional data obtained from dietary histories and 24-hour recalls, dietary histories provided more accurate information. Data provided for the three groups using 24-hour recalls and seven day food records reflected similar results. The generalization can be made that in some instances, 24-hour recalls and seven day food records may be used interchangeably.

Nutrition Education

Nutrition education for the elderly should be emphasized in congregate meal settings to aide in overcoming relatively inadequate diets of the elderly in relation to other groups (25). Contrary to what most older individuals are familiar with, the following statement indicates that ". . . effective nutrition education for the elderly starts with the premise that food is good and everyone deserves

good food (26, p. 25). Factors including age, sex, income sources, educational background, living conditions, and nutrition knowledge all play an extremely important role in consumption patterns of the elderly. Therefore, development of nutritior education programs must consider numerous factors in order to provide optimal benefits for the participants. Much of the nutrition education possessed by the elderly is a culmination of knowledge gained from mass media, family or community members, which may be misleading, confusing, and in some cases, erroneous (35).

Nutrition education for the elderly requires both motivation and management in order to be effective. Senior citizens should become enthusiastic and take an active part in considering the importance of adequate nutrition as well as overcome any limitations responsible for hindering proper dietary intake. Management skills concerning meal preparation, restricted diets, and food budgeting are then built around existing nutritional knowledge (26). Every case is individual, depending upon the backgrounds of those involved and should be treated as such.

Information concerning nutrition education may be imparted upon the target population of elderly in a variety of ways. Studies indicate that the most highly successful method of instruction is that which is conducted on a peer level, with a less formalized, rigid approach (19). Active learning, with group participation in actual experiences related to nutrition as well as passive learning, where the elderly listen and observe educational activities are two highly useful methods of instruction (35). Basically,

> . . . programs should be developed in keeping with the realization that changing food and nutrition ideas or

> practices is not a single event but that people move towards change through a multiplicity of steps (35, p. 86).

Television, slide shows, lecturers, and printed material such as newspapers and pamphlets geared to the educational level of the group at hand are extremely important (35).

Congregate Meal Programs

In 1968, concern for the nutritional and social needs of the elderly attracted nationwide interest. Consequently, Title IV of the federal Older Americans Act funded a pilot program to pinpoint major areas of nutritional concern for senior citizens. Findings indicated that

> . . . congregate meals for groups of elderly people fosters social interaction, facilitates the delivery of supportive services and meets emotional need, while at the same time it improves nutrition (1, p. 1).

Therefore, in 1969, the White House Conference on Food, Nutrition, and Health recommended congregate meals with accompanying nutrition education programs to be provided for the elderly. Funding for these meals was provided by Title VII, now known as Title III-C, of the Older Americans Act. Oklahoma received a portion of these funds in 1973, to provide one meal a day which meets one-third of the Recommended Dietary Allowances for low income citizens aged 60 and older and their spouses in a congregate meal setting. Individuals eligible for the congregate meal program qualify for a number of reasons: low income resulting in an inability to prepare nutritious, well-balanced meals, feelings of isolation and rejection, lack of physical capabilities or knowledge related to meal preparation, or limited ability to shop for nutritious food and beverages. Meals are offered free or at

a reduced rate and may be paid for with food stamps. In 1979, the Payne County Elderly Nutrition Program was initiated with a site in Cushing, Oklahoma, and one in Stillwater, Oklahoma, together serving meals to approximately 225 older adults. In addition to the meals and nutrition provided at the site, provisions must also be made for social services including transportation, referral services, shopping assistance, health and welfare counseling, nutrition education, and recreation (1).

Summary

Aging is an on-going process affecting all segments of the population from birth to death (46). Nutrition is a vitally important factor in determining health status, longevity, and a feeling of well-being in an individual. The elderly population tends to consume calorically dense food, with common nutrient deficiencies including vitamin C, vitamin A, and calcium. Psychological, physiological, economic, and social variables influence the nutritional status of older adults. Emphasis, therefore, should be placed upon factors affecting nutrition, including age, sex, income sources, living conditions, educational background, and nutrition knowledge in order that nutrition education programs may be developed for the ever increasing elderly population.

CHAPTER III

METHODS AND PROCEDURES

Included in this chapter were the population and sample size chosen for this study, and sections concerning research design, instrumentation selection, data collection, and methods of statistical analyzation of results. The purpose of this study was to determine the nutritional adequacy of the diet in relation to nutrition knowledge and to selected socioeconomic and demographic variables of the elderly participants in the Payne County Elderly Nutrition Center, Stillwater, Oklahoma.

Population and Sample

The population from which the final sample was drawn included those participants attending the Payne County Elderly Nutrition Program (PCENP) located in Stillwater, Oklahoma, including an average daily total of approximately 110 individuals. Those people comprising the total population were aged 60 or older. Spouses of these individuals were also able to participate in the program. Participants in the program were eligible for several reasons: inability to eat adequate meals due to cost, lack of knowledge, or physical ability to prepare nutritious food, feelings of rejection or loneliness, lack of desire to eat or cook alone, or limited capabilities related to shopping for a balanced array of foods and beverages.

Plans for this research were presented and discussed with the site manager of the Payne County Elderly Nutrition Center, Stillwater, Oklahoma and permission was obtained to conduct the study. All elderly individuals regularly attending the program at the congregate meal site were asked to participate in this research. Forty individuals were willing to sign a consent form and complete two interviews. Hence, they were considered the sample population for this study. During the interview process, three people became disinterested in participating in a second interview, and four more became ill and no longer attended the site. Efforts were made to contact them in their homes; however, three of the four were not well enough to continue the study. Thus, data was obtained from 33 elderly individuals: 29 females and four males.

Instrumentation

Initially, a literature review was conducted to obtain background information as a basis for development of the problem statement, objectives, hypothesis, assumptions, and limitations for this study. Following the review of literature, the researcher used several instruments to develop those necessary to collect information needed in this study. The instruments included selected personal and demographic questions concerning income sources, living conditions, educational background, and nutrition knowledge for the purpose of determining the effect of these variables on nutritional adequacy of the diets of the elderly subjects.

In order to meet the objectives stated in Chapter I, the procedure chosen for this research study was based upon a questionnaire format

developed for the Food, Nutrition and Institution Administration Department Fiber Study (54), which included data on cholesterol and dietary fiber intake by selected groups in the population, as well as other dietary intake information. The interview form developed for the Presidential Challenge Grant had been previously validated. Questions concerning nutrition knowledge, educational level, income, and living conditions were developed by the researcher in reference to the format used in the Presidential Challenge Grant Fiber Study and the format used by Rigg (29) in 1973 and Howell and Loeb (14) in 1969. The questionnaire developed by the researcher (see Appendix A) included a 24-hour recall of all food and beverages consumed.

Two surveys were used, each divided into two segments with questions related to the objectives stated in Chapter I. The initial survey included a 24-hour recall, prefaced by a comprehensive introduction explaining to the participants the necessity of reporting accurate food consumption patterns for the previous day. Part II consisted of 37 general questions concerning dietary intake patterns, living conditions, and past medical history. The second survey included a 24-hour recall as well as 25 questions related to educational background, nutrition knowledge, income, and attitudes toward the PCENP.

Included on the food recall form were provisions for obtaining the interviewee's name and code number, as well as day of the week, date, and the interviewer's name. Responses were kept in strict confidence and names of the participants were deleted when analyzing the data obtained for the study. Since the interview was designed in part for the Presidential Challenge Grant, the researcher chose to

statistically analyze only those responses directly related to the selected socioeconomic and demographic variables mentioned in Chapter I, including age, sex, income sources, education, living conditions, and nutrition knowledge (see Objectives, Chapter I).

Each interview was scheduled to last approximately 30 minutes, and was designed to include a majority of one word responses to facilitate computer coding in analyses of the data. Ten individuals not included in the study were chosen to participate in the pretest of the interview instrument. They were asked to make suggestions concerning clarity of the questions and the appropriateness of the amount of time the instrument would take to administer. The participants recommended that no changes be made in the instrument following the pretest.

Data Collection

The interviews were conducted by the researcher and a trained assistant over a three month span during October and December, 1981, from 11:00 a.m. to 1:00 p.m. at the Stillwater site. After identifying the subjects, each interviewer conducted a 30 minute interview with each participant to whom they were assigned. Upon completion of a consent form, the participant was then asked to recall food and beverages consumed from the previous day. Food models were constructed by the researcher and assistant to represent one-quarter, one-third, one-half, and one cup measures to ensure accuracy of 24-hour recall responses. Equally helpful was the usage of a plastic set of glasses ranging in size from four ounces to 16 ounces as well as a ruler to estimate thickness and length of food items when deemed necessary. Following the 24-hour recall, the remainder of each survey

was administered. When all of the initial surveys were completed, the interviewers exchanged lists of participating individuals and conducted Survey II using the same procedure. The exchanging of lists was done to ensure consistent results. A time lapse of four weeks existed between each subject's first and second interview. Gratitude was expressed to all individuals who completed both interviews with a cake delivered to the meal site during the luncheon hour.

Statistical Analyses

Analyses of results were done in cooperation with the Statistics Department at Oklahoma State University. Information from the questionnaire was coded on 224, 80 column computer cards and analyzed by the Statistical Analysis System commonly referred to as SAS.

Each food and beverage consumed in the 24-hour period was assigned a numerical code number and multiple to determine the portion size ingested. The data obtained was analyzed to determine the amounts of calories, protein, calcium, vitamin A, vitamin C, niacin, iron, riboflavin, and thiamin in each of the 24-hour recalls for all participants. A computer dietary program designed for a beginning course in nutrition at Oklahoma State University was used to determine nutrient composition of the food and beverages consumed by the participants. Food composition for computer analyses was derived from Bowes and Church, Food Values of Portions Commonly Used (6) and the United States Department of Agriculture Handbook No. 8 (50), in cooperation with the Food, Nutrition and Institution Administration Department at Oklahoma State University.

Questions pertaining to nutrition knowledge and living conditions were tabulated according to the number of correct responses. Each of these two categories of questions then received a total score, which was compared to percentages of the Recommended Dietary Allowances (RDA) obtained for calories, protein, calcium, vitamin A, vitamin C, niacin, iron, riboflavin, and thiamin through usage of correlation coefficients. Age, sex, income, and educational backgrounds were analyzed independently in relationship to nutrient percentages using the Duncan multiple range test and analysis of variance procedures. Frequency distributions were determined for additional questions pertaining to the objectives stated in Chapter I to provide additional background data to assist in interpreting the findings of the study.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to determine the effects of age, sex, living conditions, income, education, and nutrition knowledge on the nutritional adequacy of the diet of the elderly. The sample population consisted of 33 individuals from the Stillwater site of the Payne County Elderly Nutrition Program, representative of an average daily population of 110 individuals. Twenty-nine subjects were female; four were male. Participants in the Payne County Elderly Nutrition Program were aged 60 or older and eligible to attend the site for a variety of reasons, including low income, physical disability, loneliness, limited knowledge of nutritional foods, or limited access to shopping facilities. Spouses of eligible participants were also able to attend the program.

This chapter focused on the results of the analyses of data obtained from the respondents in conjunction with the objectives of the research outlined in Chapter I. The analyses of data which identified the effects of age, sex, income, education, living conditions, and nutrition knowledge has been presented in the following sequence: 1) Mean Intake of Nutrients Studied, 2) Correlation Coefficients Between Nutrients Studied, 3) Variables Related to Nutritional Adequacy of the Diet, 4) Frequency Distribution of Descriptive Data, and 5) Testing the Hypothesis.

Two separate interviews (see Appendix A) were administered to the sample population of elderly. Data obtained were analyzed using analysis of variance, Duncan multiple range test, correlation coefficients, and frequency distribution procedures. Nutrient analysis based upon mean percentages were determined using the Recommended Dietary Allowances, Revised 1980 (8), for males and females in the 51 years and older category (see Appendix B).

Description of Respondents

Information concerning percentages of the sample population in each age and sex group, educational level, income bracket, and food budget expenditures were presented in Table I. Of the age groups studied, the majority of the respondents (14), 42 percent of the participants in this study, were aged 65 to 74. Sixty-six percent (22) of the respondents were aged 75 and under. The smallest group was comprised of three participants over 85 years old, or nine percent of the population. Women comprised approximately 85 percent (29) of the population studied, the majority of the sample.

Sixty-six percent (22) of the participants had a level of educational attainment of high school graduate or less. The majority of the sample in terms of educational attainment, 27 percent (9), had less than an eighth grade education, while the smallest segment of the population, or 12 percent (4), were college graduates.

When individuals were asked to identify their sources of income, it was determined that 31 percent (12) of the elderly individuals obtained retirement earnings. Fifteen percent (6) received social security paychecks, and 15 percent (5) received welfare

TABLE I

NUMBER AND PERCENTAGES OF SUBJECTS STUDIED

	Number	Percentages*
Age (Years)		
55-64	8	24
65-74	14	42
75-84	8	24
85-94	3	9
Totals	33	99
Sex		
Male	4	15
Female	29	85
Totals	33	100
Education		
4th-8th	9	27
9th-12th	5	15
High School	8	24
Attended College	6	18
College Graduate	4	12
Totals	32	96
Income (Weekly Food Budget)		
$0.00-$10.00	7	21
$11.00-$20.00	13	40
$21.00-$30.00	9	28
$31.00-$40.00	3	9
Totals	32	98
Income Sources		
Social Security	6	15
Retirement	12	31
Welfare	5	15
Private	6	15
Savings	9	23
Totals	38	99

*Based on 100 percent, rounded for convenience.

income. Fifteen percent (6) of the participants received private funding, and 23 percent (9) used accumulated savings for spending purposes.

The amount of money spent weekly on consumables varied within the sample population. Sixty-one percent (20) of the population spent $20.00 or less each week on food expenditures. Twenty-eight percent (9) purchased $21.00 to $30.00 worth of food on a weekly basis. Thirty-one dollars to $40.00 was spent on consumables by nine percent (3) of the group studied.

Mean Intake of Nutrients Studied

Results of the study indicated that the sample population as a group obtained 75 percent or more of the 1980 Recommended Dietary Allowance (see Appendix B) for all nutrients studied, including calories, protein, calcium, vitamin A, vitamin C, niacin, iron, riboflavin, and thiamin (Table II). When this information was compared with similar studies of the elderly (23), percentages of the Recommended Dietary Allowances obtained by the sample population were higher in this research. The data may be such for a variety of reasons.

One criterion for congregate meal sites is that one-third of the recommended nutrients for the elderly must be provided in the noontime meal. This means that the participants consumed 33.33 percent of each nutrient during lunch, assuming all food provided was consumed. If two more equally nutritious meals or a variety of nutritious snacks are consumed within the same day, it could be assumed that 100 percent of the nutrients would be consumed for the elderly.

TABLE II

MEAN AND STANDARD DEVIATION PERCENTAGES
OF RECOMMENDED DIETARY ALLOWANCE
OF NUTRIENTS FOR PARTICIPANTS

Nutrient	Mean Intake by Percent of the RDA*	Standard Deviation Percentage
Calories	76.64	20.92
Protein (g)	143.45	52.82
Calcium (mg)	90.08	43.11
Vitamin A (μg Re)	522.46	534.17
Vitamin c (mg)	124.95	81.85
Niacin (mg NE)	102.21	51.46
Iron (mg)	95.53	28.35
Riboflavin (mg)	169.54	101.97
Thiamin (mg)	82.46	24.95

*100 percent = 1980 Recommended Dietary Allowances for 51 years and older.

Another reason may be that those individuals willing to participate in both interviews of the study may have been more interested in their nutritional well-being than those participants choosing not to participate in this research. This assumption was made because of the time and effort involved by the subjects in recalling all food and beverages consumed within the past day, and for 63 additional questions solicited on two separate occasions. If the assumption was correct, the sample population may also have eating habits better than those not participating in the study.

Finally, when evaluating percentages of the mean intake of nutrients in a small population, the standard deviation from the mean should be noted (Table II). Protein, vitamin A, vitamin C, niacin, and riboflavin intake varied more than 50 percent from the mean, which may have indicated a wide range of responses in a limited sample size. Information would then be less representative of the sample population because of such fluctuation.

Correlation Coefficients Between Nutrients Studied

The findings presented in Table III identify the correlation between each nutrient consumed and the intake of each of the other nine nutrients. It was noted that several nutrients increased in relation to an increase in other nutrients at a significance level of $P<0.0001$. A dietary increase of calories resulted in increased levels of protein, iron, and thiamin. An increase in dietary protein of the subjects resulted in subsequent increases of calories, calcium, niacin, and iron in the sample population. When niacin levels within the diet were high, a correlation was noted in increases of protein, vitamin A, iron, and riboflavin. Iron increases showed a significant level of increase in the amount of calories, protein, vitamin A, niacin, riboflavin, and thiamin ingested.

At a significance level of $P<0.05$, correlations between several nutrients were also noted (Table III). In the diets of the 33 subjects studied, an increase in caloric intake resulted in an increase in levels of calcium, niacin, and riboflavin in the diet. As

TABLE III

CORRELATION COEFFICIENT AND SIGNIFICANCE LEVEL BETWEEN THE NUTRIENTS CONSUMED BY THE SAMPLE POPULATION

Nutrients	Calories	Protein	Calcium	Vitamin A	Vitamin C	Niacin	Iron	Riboflavin	Thiamin
Calories	1.0000 0.0000	0.8000 0.0001**	0.7378 0.0001**	0.1947 0.2774	0.1389 0.4407	0.3476 0.0317*	0.6151 0.0001**	0.4865 0.0041*	0.8008 0.0001**
Protein	0.8000 0.0001**	0.0001 0.0000	0.6892 0.0001**	0.2592 0.1298	0.2744 0.1222	0.6398 0.0001**	0.6960 0.0001**	0.5055 0.0027*	0.7381 0.0001**
Calcium	0.7378 0.0001**	0.6892 0.0001**	1.0000 0.0000	0.1248 0.4888	0.1362 0.4496	0.2019 0.2598	0.3947 0.0230*	0.4685 0.0060*	0.7326 0.0001**
Vitamin A	0.1947 0.2774	0.2692 0.1298	0.1248 0.4888	1.0000 0.0000	0.1589 0.3769	0.6446 0.0001**	0.6489 0.0001**	0.9181 0.0001**	0.2176 0.2236
Vitamin C	0.1389 0.4407	0.2744 0.1222	0.1362 0.4496	0.1589 0.3769	1.0000 0.0000	0.4119 0.0172*	0.3438 0.0501*	0.1496 0.4058*	0.4281 0.0129*
Niacin	0.3746 0.0317*	0.6938 0.0001**	0.2019 0.2598	0.6446 0.0001**	0.4119 0.0172*	1.0000 0.0000	0.7714 0.0001**	0.6491 0.0001**	0.4189 0.0152*
Iron	0.6151 0.0001**	0.6960 0.0001**	013947 0.0230*	0.6489 0.0001**	0.3438 0.0501*	0.7714 0.0001**	1.0000 0.0000	0.7355 0.0001**	0.6747 0.0001**
Riboflavin	0.4865 0.0041*	0.5055 0.0027*	0.4685 0.0060*	0.9181 0.0001**	0.1496 0.4058	0.6491 0.0001**	0.7355 0.0001**	1.0000 0.0000	0.4920 0.0036**
Thiamin	0.8008 0.0001**	0.7381 0.0001**	0.7326 0.0001**	0.2176 0.2236	0.4281 0.0129*	0.4189 0.0152*	0.6747 0.0001**	0.4920 0.0036*	1.0000 0.0000

*Significant at the P<0.0001 level.

**Significant at the P<0.05 level.

protein intake increased, mean intakes of riboflavin and thiamin levels increased. When levels of ingested calcium increased, a corresponding increase was noted for mean percentages of calories, protein, iron, and riboflavin. Greater levels of niacin consumed by the participants reflected a significant increase in levels of vitamin C and thiamin. When the intake of iron increased, it was observed that all nutrients studied increased correspondingly at the $P<0.05$ level of significance. Niacin, iron, and riboflavin showed an increase in the diet of the elderly sample population when vitamin C intake increased.

No significant pattern was noted when correlations were determined between calories, protein, calcium, vitamin A, vitamin C, iron, riboflavin, thiamin, and niacin. Regardless of which nutrients increased in intake, the incidence of increased consumption of related nutrients could not be predicted. Other research findings indicated, however, that foods rich in protein tend to contain appreciable amounts of iron, thiamin, riboflavin, and niacin (13), as was similarly noted in results of this research. An assumption may be made that a wide range of food consumption patterns and habits within the sample population, due to dietary restrictions in special diets, and related variables such as income and food accessibility, may reflect the observed pattern of correlation between nutrients consumed.

Variables Related to Nutritional Adequacy of the Diet

Information concerning mean percentages of nutrients consumed in relation to sex, age, income sources, and educational background was presented in Table IV. Appendix C identifies analysis of variance

TABLE IV

DUNCAN MULTIPLE RANGE TEST MEAN PERCENTAGES OF NUTRIENTS CONSUMED RELATED TO THE EFFECT OF SEX, AGE, EDUCATION, AND INCOME SOURCES FOR THE ELDERLY BASED ON THE RECOMMENDED DIETARY ALLOWANCES

Variables	Subject No.	KCal	Protein	Calcium	Vitamin A	Vitamin C	Niacin	Iron	Riboflavin	Thiamin
Sex										
Male	4	59.92	101.11	71.23	336.58	69.16	78.28	94.50	114.01	70.20
Female	29	78.94	149.29	92.87	547.90	132.64	105.51	95.67	177.19	84.15
Total	33									
Age										
55-65	8	83.53	157.38	97.60	334.52	95.31	99.75	88.56	150.57	80.68
65-74	14	74.01	136.74	84.84	562.11	114.94	98.94	98.96	173.45	81.26
75-84	8	72.88	143.79	95.44	617.30	168.02	112.02	99.31	178.30	86.69
85-94	3	80.56	136.74	80.10	583.89	135.83	97.30	88.00	178.47	81.50
Total	33									
Education										
4th-8th	9	84.95	172.22	114.60	343.64	101.01	96.99	92.00	160.04	90.55
9th-12th	5	69.95	116.59	79.18	652.85	126.00	88.61	84.60	183.51	73.80
High School	8	64.23	107.69	53.28	380.83	97.91	86.98	83.00	121.39	69.66
Attended College	6	85.09	159.65	111.48	612.12	187.36	111.37	109.50	200.65	90.65
College Graduate	4	78.22	159.45	80.10	739.86	134.58	148.68	119.25	196.19	86.77
Total	32									
Income (Weekly Food Budget)										
$0.00-$10.00	7	71.62	152.96	79.06	666.12	120.83	142.26	108.28	220.97	80.72
$11.00-$20.00	13	79.67	144.98	96.85	377.05	119.48	93.45	95.76	161.06	86.55
$21.00-$30.00	9	80.67	155.80	98.22	421.40	134.62	96.22	94.16	152.95	82.22
$31.00-$40.00	3	62.84	76.13	48.79	383.92	124.72	66.02	66.16	111.66	67.33
Total	33									
Income (Sources)										
Social Security	6	78.39	146.19	92.72	396.92	125.60	95.40	94.17	151.15	83.70
Retirement	12	75.84	144.04	79.78	547.13	145.34	114.70	106.86	163.24	85.90
Welfare	5	97.02	197.95	131.41	587.29	109.66	129.38	110.00	220.08	103.70
Private	6	77.77	119.94	81.54	474.92	179.06	102.58	97.91	155.23	90.09
Savings	9	76.58	140.80	97.98	498.04	142.40	103.17	95.33	169.81	90.60
Total	38									

tables for the aforementioned variables. Table V depicts the correlation coefficients between living conditions and nutrition knowledge scores and nutrients consumed.

TABLE V

CORRELATION COEFFICIENT BETWEEN LIVING CONDITIONS AND NUTRITION KNOWLEDGE SCORES AND NUTRIENTS CONSUMED BY THE ELDERLY

Nutrients	Living Conditions	Nutrition Knowledge
Calories	.1872 .2967	.1317 .4464
Protein (gm)	.0256 .8875	.1473 .4131
Calcium (mg)	.0531 .7689	-.0368 .8388
Vitamin A (μg Re)	-.1497 .4054	-.0025 .9889
Vitamin C (mg)	-.2730 .1242	.3515 .0499
Niacin (mg NE)	-.1805 .3146	.1982 .2687
Iron (mg)	-.2289 .2000	.2721 .1255
Riboflavin (mg)	-.0699 .6990	.0864 .9620
Thiamin (mg)	-.7260 .6878	.2115 .2372

Age Related to Nutritional Adequacy of the Diet

As shown in Table IV, when age was related to caloric consumption of participating individuals, it was determined that caloric intake patterns were not significantly affected at $P<0.05$ using the analysis of variance test. Further analysis of the affect of age on caloric intake using the Duncan multiple range test indicated that the mean percent of calories consumed ranged from 72 to 83 percent of the Recommended Dietary Allowance. This difference was statistically similar at the $P<0.05$ level.

Age differences had no significant effect on protein consumption of the elderly, with a level of significance of 0.86 using the analysis of variance procedure. The youngest participants, aged 55 to 64, consumed 157 percent of the Recommended Dietary Allowance for protein, while the participants aged 65 to 74 and 85 to 94 had the lowest consumption at 136 percent of the Recommended Dietary Allowance, according to the Duncan test. Statistically, this difference was not significant.

According to the analysis of variance procedure, calcium consumption was not significantly affected by age in the sample population. The Duncan multiple range test revealed a small variation between age groups in regards to calcium ingestion. The lowest levels of consumption involved the group aged 85 and older, with 80 percent of the RDA for calcium. Those individuals aged 55 to 64 consumed 97 percent of the RDA, the largest percentage of calcium consumed within the population studied. This difference was not statistically significant.

Vitamin A intake was not significantly affected by age differentials within the sample population of adults, according to the analysis of variance test. The Duncan multiple range test showed a 562 percent consumption of the RDA for vitamin A in the 75 to 84 year old group, with the highest consumption visible in the 65 to 74 year old group with 617 percent of the RDA for vitamin A. This was not statistically significant at the $P<0.05$ level.

Iron levels in the diet were not significantly affected by age levels in the elderly population using the analysis of variance procedure. The lowest levels of the Recommended Dietary Allowance consumed was in the 55 to 64 age level at 80 percent of the RDA while the 75 to 84 years old group consumed the most iron, 86 percent of the Recommended Dietary Allowance.

Age did not statistically affect levels of thiamin in the diet of the sample population. The youngest group, aged 55 to 64, consumed 80 percent of the RDA, while the 75 to 84 age group ingested 86 percent of the RDA for thiamin, according to the Duncan multiple range test. This was not statistically significant at the $P<0.05$ level of significance.

When riboflavin intake was analyzed according to age, no significant difference was noted at a level of $P<0.05$. Those individuals aged 55 to 64 consumed the least amount of riboflavin, 80 percent of the RDA. Eighty-six percent of the RDA was obtained by subjects aged 75 to 84, the highest percentage of the RDA for riboflavin consumed. This was not statistically significant.

In summary, analysis of variance testing findings reflected that age did not significantly influence nutritional adequacy of the diet

in the sample population of elderly studied. Despite the fact that as the aging process progresses, physical capabilities digress, individuals in this study did not have inadequate dietary intake as a result. One assumption could be that the capabilities related to acquisition, preparation, and consumption of food and beverages did not decrease as a function of age within the sample studied. In this study, intake within the sample group was above average in terms of adequacy, regardless of age.

Sex Related to Nutritional Adequacy of the Diet

Table IV shows that sexual differentiation had some bearing on calories ingested as reflected by a $P<0.08$ level of significance. Although not statistically significant, the Duncan multiple range test revealed that the females in the sample population consumed 78 percent of the RDA for calories, while males consumed 59 percent of the RDA for calories.

Protein consumption was not significantly affected by sexual differences within the sample population using the analysis of variance procedure. According to the Duncan test, males tended to consume less protein than females with 101 percent and 149 percent of the RDA, respectively. This was not statistically significant at the $P<0.05$ level.

Calcium intake was not affected by sex differentials within the group of elderly studied using the analysis of variance test. Males consumed 71 percent of the RDA for calcium, while females consumed 92 percent of the RDA for calcium. The Duncan multiple range test did

not reveal a significant difference between the calcium intake by males and females studied at the $P<0.05$ level.

Sex differences did not significantly influence consumption levels of vitamin A at the $P<0.05$ level according to the analysis of variance procedure. The Duncan test indicated that the men consumed 336 percent of the RDA for vitamin A while the women conversely consumed 547 percent of the RDA for vitamin A. Statistically, this was not significant at the $P<0.05$ level.

Sex differentiation had no significant effect on vitamin C ingestion within the sample population, using the analysis of variance test. According to the Duncan multiple range test, males consumed the least amount of vitamin C, or 69 percent of the RDA, while females consumed 132 percent of the RDA. This was not statistically significant at the $P<0.05$ level.

Differences in sex, similarly, had no significant effect on niacin consumption according to the analysis of variance test. Men consumed less niacin than women at 78 percent of the RDA as compared to 105 percent of the RDA, respectively, according to the Duncan test. This was not statistically significant at the $P<0.05$ level.

Iron consumption levels were not significantly affected by differences in the two sexes according to the analysis of variance test. The Duncan multiple range test revealed that males and females in the population consumed 94 percent and 95 percent of the RDA for iron, respectively, although this was not statistically significant at the $P<0.05$ level.

Thiamin levels within the diet were not significantly influenced by differences in sex within the sample population using the analysis

of variance procedure. Males obtained 70 percent of the thiamin recommended in their diet, while females obtained 84 percent of the RDA for thiamin, according to the Duncan test. This was not statistically significant at the $P<0.05$ level.

Analysis of variance tests indicated that riboflavin intake was not significantly affected by sex differentials within the elderly studied. The Duncan multiple range test indicated that the men consumed 114 percent of the RDA for riboflavin, while the females ingested 177 percent of the RDA for riboflavin. Statistically, this was not significant at the 0.05 level.

Findings of this segment of analyses indicated that sex differences within the sample population did not significantly affect nutritional adequacy of the diet except in the case of caloric consumption. The 29 women in the study consumed significantly more calories than the four males. This finding may be somewhat biased due to the disproportional number of women compared to men in the sample population. Elderly women may be more sedentary than men and develop a greater interest in food as a recreational or social activity than men, thus resulting in a higher consumption of calorically dense food and beverages.

Income Related to Nutritional Adequacy of the Diet

Table IV shows that when caloric consumption was compared to sources of income, the analysis of variance test indicated that income sources did not significantly affect levels of caloric intake, except in those individuals obtaining private income sources.

Individuals with welfare as an income source consumed the highest percentage of calories, with 97 percent of the RDA. Seventy-five percent of the Recommended Dietary Allowance for calories, the lowest amount consumed within the population, was observed in the elderly using retirement income sources.

The amount of money spent weekly on food and beverages had no significant effect at the $P<0.05$ level when compared to the caloric consumption within the population. When $21.00 to $30.00 was spent weekly on the food budget, the highest levels of calories ingested, or 80 percent of the RDA, was consumed by the subjects. Conversely, when $31.00 to $40.00 was spent on a weekly basis for consumables, the lowest intake of calories was observed, or 62 percent of the RDA.

Protein consumption was affected significantly by private sources of income in the elderly sample population, according to the analysis of variance procedure. The Duncan multiple range test indicated that those subjects using welfare as a source of income consumed 197 percent of the RDA for protein while those individuals without welfare funding ingested only 133 percent of the RDA for protein. This was significantly different at the $P<0.05$ level. Weekly amounts of income spent on food and beverages had no significant affect on protein consumed at a $P<0.05$ level. When $31.00 to $40.00 was spent on food each week, 76 percent of the RDA for protein was ingested. However, when $21.00 to $30.00 was spent for food purchases, the highest level of protein consumption was noted at 155 percent of the RDA.

Except for in the case of private income sources, calcium was not significantly affected by income sources in the sample population

according to the analysis of variance procedure. The Duncan mulitple range test showed a significant level of difference in calcium ingested in respect to welfare income. Those subjects in the research study who obtained welfare consumed 131 percent of the RDA, while those without welfare income consumed only 82 percent of the RDA for calcium. Seventy-nine percent of the RDA for calcium was ingested by those elderly people using retirement funding as an income source. The amount of money spent each week for food and beverages did not affect calcium consumption at a significance level of $P<0.05$. Ninety-eight percent of the RDA for calcium, the highest intake in the sample population based upon expenditures for food, was consumed by subjects spending $21.00 to $30.00 each week on consumables. Individuals spending $31.00 to $40.00 per week on the food budget consumed the lowest intake for calcium, or 48 percent of the RDA.

Vitamin A consumption was not significantly affected by all income sources identified in this research, with the exception of social security income according to the analysis of variance test. While the analysis of variance procedure revealed a significant level of effect of social security on vitamin A consumption, the Duncan test revealed that social security recipients obtained only 396 percent of the RDA for vitamin A while 987 percent of the RDA for vitamin A was ingested by people living on other forms of income. Welfare recipients consumed the highest percentage of the RDA for vitamin A, or 587 percent, while people obtaining social security income ingested the lowest level of vitamin A. The amount of money spent each week for food and beverages had no significant effect on vitamin A consumption within the sample population. When less than

$10.00 was spent on food each week, 666 percent of the RDA for vitamin A was consumed. Those participants spending $11.00 to $20.00 each week for consumables showed 377 percent of the RDA for vitamin A, the least amount consumed by the subjects studied.

Income sources had no statistically significant effect on increased consumption of vitamin C at the $P<0.05$ level according to the analysis of variance test. When private income sources were used by the elderly population, 179 percent of the RDA for vitamin C was ingested, the highest level of vitamin C noted. The amount of money allocated each week for food showed no level of statistical significance at the $P<0.05$ level, according to the analysis of variance procedure, indicating that vitamin C levels were not altered in the diet according to the amount of money spent weekly on feed. When $21.00 to $30.00 was spent each week for food and beverages, vitamin C levels were the highest at 134 percent of the RDA for the elderly. When $11.00 to $20.00 was spent weekly, lowest levels of intake were present at 119 percent of the RDA.

Niacin consumption levels within the diet were not significantly affected by income sources in the population according to the analysis of variance procedure. Social security recipients obtained the least amount of niacin within the diet with 95 percent of the RDA, while those individuals living on welfare as a source of income obtained 129 percent of the RDA for niacin, the highest percentage observed. When $10.00 or less was spent each week for food, the highest levels of niacin were obtained in the diet at 142 percent of the RDA. In elderly participants spending $31.00 to $40.00 weekly on food expenditures, 66 percent of the RDA for niacin was consumed by the subjects, the least amount consumed.

The analysis of variance test revealed that sources of income did not statistically affect the level of iron consumption within the diet, according to the Duncan test. The highest amount of iron consumed in relation to the RDA was 110 percent, noted in those people receiving welfare income. Ninety-four percent of the RDA was ingested by people relying upon social security funding for income. Weekly expenditures for food and beverages showed no significant effect on iron consumption patterns within the diet of the elderly studied according to the analysis of variance procedure. When $10.00 or less was spent each on food and beverages, the highest intake of iron was noted, with 108 percent of the RDA. The greatest weekly expenditure for food noted in the sample population, $31.00 to $40.00, resulted in the lowest intake of iron, 66 percent of the RDA.

Social security income statistically affected the levels of riboflavin at a $P<0.05$ level within the sample population according to the analysis of variance procedure. The highest levels of riboflavin, or 220 percent of the RDA, were consumed by welfare recipients. Eighty-three percent of the RDA for riboflavin, the least amount ingested by the sample population, was noted in people who received social security income. Analysis of variance tests showed that the amount of money spent on food weekly had no significant effect on consumption of riboflavin in the diet of the elderly. Two hundred and twenty percent of the RDA for riboflavin, the highest level of ingestion observed, was consumed by elderly individuals spending less than $10.00 each week for food. When $31.00 to $40.00 was spent weekly for food purchases, the least amount of riboflavin was consumed in the diet, or 111 percent of the RDA.

Income sources in the form of private funds, had a statistically significant effect on thiamin consumption within the population according to the analysis of variance procedure. People living on welfare incomes consumed the highest percentage of the RDA for thiamin, or 103 percent. The lowest level of thiamin, 83 percent of the RDA, was consumed by those individuals obtaining social security income. The analysis of variance test indicated that the weekly amount spent for food purchases had no significant effect on thiamin consumption within the diet of the group studied. Individuals spending $11.00 to $20.00 on the weekly food budget consumed the highest levels of thiamin, or 86 percent of the RDA, while only 67 percent of the RDA was consumed by individuals spending more than $31.00 each week for food.

When income sources were statistically analyzed according to nutrient intake, social security and private sources of income each affected nutritional adequacy of the elderly individual's diet. Analysis of variance procedures indicated that private funds tended to have the most frequently noted affect on nutrient increases, whereas welfare and retirement incomes affected increases in dietary adequacy less frequently than other income sources studied. Private funds may be substantially higher than income from other sources, due to interest accumulation in savings accounts, increased dividends or stock mergers and splits in the stock market, and inflationary increases in property resale in the real estate business. Consequently, the elderly individual benefiting from such financial gains may invest increased time and money in the food budget, thereby attaining a higher level of nutrient intake. In addition, siblings may contribute substantially to private incomes of the elderly, thereby increasing financial holdings in the population studied.

Analysis of data indicated that weekly food and beverage expenditures had no statistically significant effect on nutritional adequacy of the diet. Generally, however, those participants spending the least amount of money per week for food had a more nutritionally balanced diet than those spending the greatest amount of money for consumables. This was true in the case of all nutrients studied, with the exception of vitamin C. When food budget expenditures of the sample population were compared to expenditure ranges for elderly individuals established by the United States Department of Agriculture (49), it was noted that the majority of the participants (61 percent) fell within the ranges of the "low cost" or "thrifty plans" for food costs. Twenty-eight percent of the sample were within the boundaries of the "moderate-cost plan," and nine percent spent money on food comparable to the "liberal plan." Elderly individuals required by income and budgeting to spend a limited amount of money on food purchases may strive to choose foods high in nutrients, and suited to their needs in order to remain healthy. When more money is allocated for the food budget, the tendency may be to buy impulse items or convenience foods, which tend to be more expensive and lacking in vitamins and minerals essential to a nutritionally adequate diet.

Percentages of the Recommended Dietary Allowances for nutrients consumed revealed that welfare recipients had the highest levels of intake of calories, protein, calcium, vitamin A, niacin, iron, riboflavin, and thiamin, according to the Duncan test. Food stamps may have been obtained by welfare recipients for a reduced rate, allowing food to be purchased at a rate considerably less than the retail price. A more nutritionally adequate diet may result when high

quality and increased quantities of food may be purchased at a reduced rate, in the elderly population using welfare as a source of income.

Educational Background Related to Nutritional Adequacy of the Diet

Table IV shows that the level of education of the participating individuals had no significant effect upon caloric consumption according to the analysis of variance test. The Duncan multiple range test showed that individuals who attended college had the highest caloric intake with 85 percent of the Recommended Dietary Allowance. High school graduates consumed the least amount of calories, with 64 percent of the RDA. Statistically, this was not significant at the $P<0.05$ level.

Protein consumption was not significantly affected by levels of education attained in the sample population at a $P<0.05$ level. Those individuals with a fourth through eighth grade education consumed the highest levels of protein, with 172 percent of the RDA, while those individuals who had graduated from high school ingested considerably less protein, with 107 percent of the RDA. The Duncan multiple range test noted a significant difference at the $P<0.05$ level between the protein consumption levels of the two educational groups.

A significance level of $P<0.01$ was noted when analyzing educational backgrounds and calcium ingestion. The Duncan test showed a significant level of difference at the $P<0.05$ level between those people attending college with 53 percent of the RDA and those completing grades nine through 12 and college graduates. The individuals

within these educational levels consumed 111 percent and 114 percent of the RDA for calcium, respectively.

Education did not have a significant effect on vitamin A consumed within the population when analysis of variance results were reviewed. Those individuals with a fourth through eighth grade education consumed 343 percent of the RDA for vitamin A. Those consuming the highest levels of vitamin A were college graduates with 739 percent of the RDA for vitamin A according to the Duncan test. This was not statistically significant at the $P<0.05$ level.

Analysis of variance tests showed that no significance at the $P<0.05$ level was noted when vitamin C consumption was compared to educational levels attained by the elderly. High school graduates consumed the least amount of vitamin C at 97 percent of the RDA, while the partcipants who attended college consumed 187 percent of the RDA for vitamin C, according to the Duncan test. Statistically, this was not significant at the $P<0.05$ level.

Niacin consumption levels were not statistically influenced in the sample population by level of educational attainment, according to the analysis of variance test or the Duncan multiple range test. College graduates consumed the highest intake of niacin, or 148 percent of the RDA, while 86 percent of the RDA for niacin, the lowest level in the study, was consumed by individuals attending high school.

Educational attainment levels did not cause iron consumption levels to vary significantly among the elderly studied, according to the analysis of variance procedure. College graduates consumed the highest levels of iron with 119 percent of the RDA in relation to scholastic level, whereas ninth through twelfth grade graduates had

consumed 84 percent of the RDA for iron. Statistically, this was not significant at the $P<0.05$ level.

The educational background of the participants did not significantly affect amounts of riboflavin in the diet at the $P<0.05$ level, according to the analysis of variance test. Individuals consuming the most riboflavin, with 200 percent of the RDA, attended college. One hundred and twenty-one percent of the RDA was the least amount consumed, in those persons graduated from high school.

No significant effect was noted when educational levels were compared to intake of thiamin in the diet using the analysis of variance test at the $P<0.05$ level. Consumption percentages varied from between 69 percent to 90 percent of the RDA for thiamin. Individuals attending but not completing college obtained the highest amounts while those attending high school consumed the least amount of thiamin.

Except in the case of calcium ingestion, no significant level of influence was noted when studying the effects of educational background on nutritional adequacy of the diet at the $P<0.05$ level using the analysis of variance test. Interestingly enough, individuals attending or graduating from college obtained the highest levels of calories, protein, calcium, vitamin A, vitamin C, niacin, iron, riboflavin, and thiamin. The assumption may be drawn that as educational level increases, nutritional adequacy of the diets of the sample population increased due to increased overall knowledge.

Living Conditions and Nutrition Knowledge Related to Nutritional Adequacy of the Diet

Analytical results of the study using correlation coefficients

indicated that the total score obtained from questions concerning living conditions had no significant affect on levels of calories, protein, calcium, vitamin A, vitamin C, niacin, iron, riboflavin, and thiamin consumed by the sample population of elderly citizens (see Table V).

Nutrition knowledge scores played no significant role in increasing or decreasing levels of the aforementioned nutrients at a significance level of $P<0.05$ (Table V). Responses to questions concerning nutrition knowledge were varied (Table VI). Tabulation of scores revealed that in more than half of the responses, subjects were able to identify good sources of vitamin C and iron. Participants in the study had the lowest percentages of correct responses when asked to identify good sources of thiamin and vitamin A, and the Basic Four food groups. When respondents were unfamiliar with the nutrient in question, a majority chose not to answer questions concerning vitamin A, calcium, thiamin, and the Basic Four food groups. Questions concerning calories, vitamin C, and iron were answered least frequently. More than a third of the responses concerning sources of calories, vitamin C, calcium, and iron were answered correctly. This may be due to the intense advertising campaigns visible in both magazines and television concerning vitamin C, iron, and calcium rich products. A strong emphasis is also placed by the media upon diet products in terms of weight reduction pills and diet food and beverage items.

It appears that scores tabulated from living conditions and nutrition knowledge did not affect nutritional adequacy of the diet. The sample population may have had a more consistent standard of

living than many senior citizens due to the stipulations provided by Title III-C for congregate meal sites. Therefore, fluctuations within the population would be less noticeable when compared to dietary intakes. Scores obtained from the nutrition knowledge segment of the questionnaire did not affect intake of nutrients, which indicated that despite what nutrition knowledge was possessed by the participants in this research, nutritional adequacy was 75 percent or more above the RDA. Another possibility might have been that no concern was placed by the subjects upon what was, in fact, necessary for optimal health.

TABLE VI

NUTRITION KNOWLEDGE RESPONSE TABULATION AND PERCENTAGES OF FOOD SOURCES

Nutrients	Good Food Choices*		Fair Food Choices*		Poor Food Choices*		No Response	
	No.	%	No.	%	No.	%	No.	%
Calories	23	39	5	8	16	24	19	29
Vitamin A	7	21	0	0	7	21	19	57
Vitamin C	18	55	1	3	3	9	11	33
Calcium	11	33	0	0	7	21	19	57
Iron	16	48	0	0	5	15	12	36
Thiamin	6	18	0	0	2	6	25	75
Basic Four	27	20	0	0	15	11	90	68

*According to Guthrie (13, p. 533).

Frequency Distribution of Descriptive Data

Additional information pertaining directly to the objectives stated in Chapter I was elicited from the participants and analyzed using frequency distribution tables. This was done to add depth to the study in terms of the participants' attitudes towards the Payne County Elderly Nutrition Program and to enhance an overview of the sample population. Tables VII, VIII, and IX depicted the data obtained using frequency distribution tables.

All of the 33 participants responded positively when asked if they enjoyed attending the Payne County Elderly Nutrition Program. Respondents chose a variety of reasons for attending the meal site. When asked if they attended because friends also attended, a third of the sample suggested that they sometimes came for that reason. Approximately one-half of the participants came because friends attended, and 21 percent said that they were not affected by them. Almost all (96 percent) of the sample population chose to attend the meal site because the food was considered good; while a small percentage (3 percent) of those attending came to the site for reasons other than that. Two-thirds attended the Payne County Elderly Nutrition Program because it gave them something to do with their spare time. Sixty-three percent sometimes came for something to do, and nine percent of the participants did not consider that to be a factor in their attendance. Almost all (90 percent) of the sample population attended the PCENP because of the high nutritional value of the food served, while a small minority (6 percent) did not feel that nutritional value influenced their decision to attend the program.

TABLE VII

FREQUENCY DISTRIBUTION OF DESCRIPTIVE DATA CONCERNING ATTITUDES TOWARDS THE PCENP (N=33)

Question Topic*	Frequency of Response	Percentage**
Program Attendance		
Enjoyment		
Yes	33	100
No	0	0
Attendance Reasons		
Friends		
Yes	16	48.4
Sometimes	10	30.3
No	7	21.2
Good Food		
Yes	32	96.9
No	1	3.0
Inexpensive		
Yes	22	66.6
Sometimes	7	21.2
No	4	12.1
Something To Do		
Yes	21	63.6
Sometimes	3	9.0
No	9	27.2
Nutrition		
Yes	30	90.9
Sometimes	1	3.0
No	2	6.0
No Food Preparation		
Yes	27	81.8
Sometimes	3	9.0
No	3	9.0
Portion Size		
Too large	3	9.0
Average	28	84.8
Too small	2	6.0
Donation		
Worthwhile		
Yes	33	100
No	0	0
Easy Method		
Yes	31	93.9
No	2	6.0

*Refer to Appendix A for actual questions elicited.

**Based on 100 percent, rounded to the nearest tenth.

TABLE VIII

FREQUENCY DISTRIBUTION OF DESCRIPTIVE DATA CONCERNING NUTRITION EDUCATION RESPONSES (N=33)

Question Topic*	Frequency of Response	Percentage**
Desirability of Nutrition Education		
Yes	20	60.6
No	13	39.3
Acceptable Programs		
Films		
Yes	13	52.0
Sometimes	6	24.0
No	6	24.0
No Response	8	--
Slides		
Yes	12	46.1
Sometimes	5	19.2
No	9	34.6
No Response	7	--
Lectures		
Yes	7	31.8
Sometimes	8	36.3
No	7	31.8
No Response	11	--
Group Discussion		
Yes	8	36.3
Sometimes	6	27.2
No	8	36.3
No Response	11	--
Television/Radio		
Yes	17	73.9
Sometimes	5	21.7
No	1	4.3
No Response	10	--
Newspapers		
Yes	17	70.8
Sometimes	4	16.6
No	3	12.5
No Response	9	--
Pamphlets and Brochures		
Yes	10	47.6
Sometimes	7	33.3
No	4	19.0
No Response	12	--

TABLE VIII (Continued)

Question Topic*	Frequency of Response	Percentage**
Games		
Yes	11	64.7
Sometimes	5	29.4
No	1	5.8
No Response	16	--

*Refer to Appendix A for actual questions elicited.

**Based on 100 percent rounded to the nearest tenth.

Portion size of the served food was considered ideal 84 percent of the time, and considered too large 9 percent of the time. Three percent of the sample population desired larger portions. Each of the 33 participants felt it worthwhile to donate money for the meal; however, 6 percent felt that a more feasible method than placing donations in envelopes on the table could be developed.

Sixty percent of the participants were interested in nutrition education information, while 39 percent were opposed to such knowledge. When asked what programs they enjoyed most to facilitate nutrition knowledge, responses varied. Television and radio were the most acceptable programs chosen, with games and newspapers considered by more than half of the participants to be highly enjoyable. Least favorable choices by the elderly were guest lecturers and group discussion.

Data concerning restricted diets was also obtained. The majority of the participants had never been on a diet designed to lose weight, and those that were strived to lose weight based upon physician's

orders. When asked about special diet patterns including modified calorie, low salt, low cholesterol, high fiber, and diabetic diets, in each case more than half of the sample had never been requested to be on one or more restricted diets.

TABLE IX

FREQUENCY DISTRIBUTION OF DESCRIPTIVE DATA CONCERNING RESTRICTED DIETS (N=33)

Question Topic*	Frequency of Response	Percentage**
Restricted Diets		
Diet to Lose Weight		
Yes	13	39.3
No	20	60.6
Prescribed by		
Physician	9	75.0
Self	2	16.6
Friend/Relative	1	8.3
Not Applicable	21	--
Low Salt Diet		
Yes	3	9.3
No	28	87.5
No Response	1	3.1
Modified Calories		
Yes-Low	8	24.2
No	25	75.7
Low Cholesterol/Fat		
Yes	6	18.1
No	27	81.8
Fiber		
High	5	15.1
Low	1	3.0
No	27	81.8
Diabetic		
Yes, With Insulin Shots	2	6.06
No	31	93.9

*Refer to Appendix A for actual questions elicited.

**Based on 100 percent, rounded to the nearest tenth.

Testing the Hypothesis

The hypothesis stated for purposes of this research was as follows:

H_1: Dietary adequacy of food intake will not be significantly different according to age, sex, income sources, education, living conditions, and nutrition knowledge of elderly adults. The researcher chose not to accept this hypothesis in part. According to the analysis of variance procedure, age and sex did not significantly affect levels of nutrient consumption within the diet. Therefore, this segment of the hypothesis was not accepted. Social security income affected levels of vitamin A and riboflavin in the diet at a significance level of $P<0.05$, causing the researcher not to accept the section of the hypothesis related to the effect of social security on these two nutrients. Private income sources affected the levels of caloric consumption, protein, calcium, and thiamin in the diet, resulting in the hypothesis not to be accepted for those nutrients. Educational attainment in the population affected levels of calcium ingested at a significance level of $P<0.01$, resulting in this part of the hypothesis not being accepted. Living conditions, nutrition knowledge, food budget expenditures, and retirement income did not statistically affect the levels of nutrient consumption within the population, resulting in the researcher's decision not to accept this portion of the hypothesis.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The purpose of this study was to determine the effects of age, sex, living conditions, income, education, and nutrition knowledge on nutritional adequacy of the diet of the elderly. A sample population of 33 elderly individuals from the Payne County Elderly Nutrition Program was interviewed on two separate occasions using the 24-hour recall method of dietary survey and a questionnaire format for data collection. Participants in the program were asked to respond to questions based upon the objectives of the research, including questions related to age, sex, income, educational background, living conditions, and nutrition knowledge. In addition, each subject was asked to recall food and beverage consumption for two 24-hour periods. Statistical analyses using analysis of variance, Duncan multiple range test, frequency distribution, and correlation coefficient were used to determine whether a select group of elderly individuals consumed nutritionally adequate diets based upon the 1980 Recommended Dietary Allowances (8), and whether nutrient consumption in the sample population is affected by age, sex, income sources, living conditions, educational background, and nutrition knowledge.

Findings showed that the sample population of 33 individuals was comprised of 29 females and four males attending the Payne County Elderly

Nutrition Program. Sixty-six percent of the participants were aged 75 or younger, and were graduated from high school or lower grades. The majority of the population obtained retirement earnings and spent $20.00 or less each week for food expenditures.

Results of the research indicated that, as a group, the sample population obtained 75 percent or more of the 1980 Recommended Dietary Allowance for calories, protein, calcium, vitamin A, vitamin C, niacin, iron, riboflavin, and thiamin. When correlation coefficients were determined between the nutrients studied, the incidence of increased consumption of related nutrients could not be predicted in any significant pattern.

When variables including age, sex, income, educational background, living conditions, and nutrition knowledge were compared to nutrient consumption within the diet, the analysis of variance test and Duncan multiple range test determined that educational background significantly affected calcium intake within the sample population. Income sources in the form of social security and private income significantly affected ingested levels of protein, calories, calcium, vitamin A, riboflavin, or thiamin. Age, sex, living conditions, and nutrition knowledge had no statistical significance on the levels of nutrients ingested.

Nutrition knowledge responses indicated that sources of vitamin C and iron were most readily identified by participants in the study. Food sources of thiamin, vitamin A, and the Basic Four food groups were least likely to be identified by the sample studied.

One hypothesis was identified for purposes of this research (Chapter I). The hypothesis was reviewed based upon findings from

this study. Elderly individuals in the sample population consumed a nutritionally adequate diet based upon 75 percent of the 1980 RDA. Social security and private income, as well as educational attainment, statistically affected levels of consumption of calories, protein, calcium, vitamin A, vitamin C, niacin, iron, thiamin, or riboflavin within the diet of the elderly participants at the Payne County Elderly Nutrition Program, resulting in the partial rejection of H_1.

Nutrition education programs emphasizing basic eating habits essential to nutritionally adequate diets should be developed for congregate meal sites. The majority of the sample population was interested in obtaining nutrition education materials and information. The most highly desirable methods of dissemination of such information to the population in over 50 percent of the responses included television and radio advertisements, games, and newspapers. From this study it was determined that current nutrition knowledge in the elderly population did not statistically affect consumption patterns of nutrients in the elderly. Since nutrition education programs were not implemented extensively at the time of this study, the researcher believed that through such programs in the future, more nutritionally adequate diets may be noted within the Stillwater congregate meal site.

Conclusions

All of the participants at the Payne County Elderly Nutrition Center, Stillwater, Oklahoma, consumed an adequate diet based on 75 percent or more of the Recommended Dietary Allowance, based upon the nutrients studied. Age, sex, living conditions, and nutrition

knowledge had no significant effect on nutritional adequacy of the diet in the sample population of elderly studied. Income, in the form of social security and private funds, significantly affected nutrient ingestion according to the analysis of variance procedure. Welfare recipients consistently obtained the highest levels of ingested nutrients in the population. As the amount of money spent weekly on the food budget decreased, an overall increase in nutritional adequacy of the diet was observed. It was noted that as educational attainment rose in the sample studied, the level of nutrient ingestion also increased. Responses to nutrition knowledge questions showed that vitamin C and iron food sources were most readily identified by the sample population, while thiamin, vitamin A, and the Basic Four food groups were seldom identified by the participants. These findings have implications for nutrition education for elderly in congregate meal programs.

Recommendations for Future Study

The results of this study suggest several recommendations for future research. A similar study using data collection methods presented in this study could be conducted comparing a sample of congregate meal participants and comparable nonparticipants to determine nutritional differences in the diets consumed. Further research of nutrition education needs may be conducted at a congregate meal program before nutrition education programs were introduced, with a follow-up study of the site after nutrition education was introduced to determine changes in nutrient consumption. Another study using a

random sample of congregate meal sites across the nation to determine differences in nutritional adequacy of the diet, could similarly be developed using data collection methods utilized for purposes of this study.

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APPENDIXES

APPENDIX A

TWENTY-FOUR HOUR RECALL AND QUESTIONNAIRE INSTRUMENT FOR ELDERLY PARTICIPANTS IN THE STILLWATER CONGREGATE MEAL SITE

FOOD RECALL OK-2

1. Date:_____ 2. Interviewer:_____

3. Subject:_____ 4. Subject No.:_____

5. Yesterday was SU=1 M=2 TU=3 W=4 TH=5 F=6 SA=7

Please tell me everything you ate and drank from the time you got up yesterday until you got up this morning. I will ask you questions meal by meal. I do not need to know how much water you drank, but I do need to know about other things, such as coffee, tea, beer, milk, etc. I also need to know about anything added to your food or drinks, such as sugar, butter, catsup, mustard, jelly, etc. Tell me how much you ate and how it was prepared. Brand names are helpful.

BEFORE BREAKFAST:

6. Did you eat anything before breakfast yesterday? YES NO
If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

BREAKFAST:

7. Did you eat breakfast yesterday? YES NO
If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

MID-MORNING SNACK:

8. Did you eat or drink anything between breakfast and lunch?
YES NO If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

LUNCH:

9. Did you eat lunch yesterday? YES NO
   If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

MID-AFTERNOON SNACK:

10. Did you eat or drink anything during the afternoon between noon and the evening meal? YES NO
    If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

EVENING MEAL:

11. Did you eat an evening meal yesterday? YES NO
    If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

EVENING SNACK:

12. Did you eat or drink anything between your evening meal and the time you went to bed last night? YES NO
    If yes, what?

a. Food/Beverage	b. Amount Consumed	c. Wght. in grams	d. ID

SUPPLEMENTS:

13. Did you take a nutritional supplement yesterday? YES NO
If yes, describe it and tell me how many tablets or capsules you took. (If an uncommon item, where was it purchased?)

	BRAND	NO.	TIME TAKEN
MULTIPLE VITAMIN WITH IRON			
MULTIPLE VITAMIN WITHOUT IRON			
IRON ONLY			
VITAMIN C			
VITAMIN B-12			
CALCIUM			
OTHER _____			

GENERAL DIETARY INFORMATION OK-1

1. Date:_____ Interviewer:_____

2. Subject's Name:_____ Subject No.:_____

3. Race: WHITE=1 BLACK=2 INDIAN=3 MEX=4 ORIENT=5 ?=6

4. Age: _____yrs.

5. How many days each week do you eat breakfast? 0 1 2 3 4 5 6 7
IF FEWER THAN 4, SKIP TO ITEM #10

6. Where do you usually eat breakfast?
OWN HOME=1 RELATIVE/FRIEND'S HOME=2 RESTAURANT=3 OTHER (_____)=5

7. Do you usually eat: A PREPARED MEAL=1 or ANYTHING CONVENIENT=2

8. Who prepares breakfast most often if a prepared meal?
MYSELF=1 WIFE=2 CHILD, OTHER RELATIVE=3 HOUSEKEEPER OR COMPANION=4 NEIGHBOR=5

9. If you do not live alone, does your family eat breakfast:
SEPARATELY=1 TOGETHER=2 VARIES=3 LIVE AND EAT ALONE=4

10. How many days a week do you usually eat something between breakfast and lunch? 0 1 2 3 4 5 6 7
IF FEWER THAN 4, SKIP TO ITEM #13

11. Where do you obtain this mid-morning snack? OWN HOME=1 RELATIVE/FRIEND'S HOME=2 RESTAURANT=3 OTHER (_____)=5

12. Do you eat then-- NO=0 SOMETIMES=1 YES=2
    a. because you are hungry?
    b. as part of social activity?
    c. for something to do?
    d. because it looks appetizing?
    e. to gain weight?
    f. doctor/dietitian advises eating often?
    g. feel better to eat frequently?

13. How many days each week do you usually eat lunch? 0 1 2 3 4 5 6 7
IF FEWER THAN 4, SKIP TO ITEM #17

14. Where do you usually eat lunch? OWN HOME=1 RELATIVE/FRIEND'S HOME=2 RESTAURANT=3 FEEDING CENTER=4 OTHER (_____)=5

15. Do you usually eat: A PREPARED MEAL=1 ANYTHING CONVENIENT=2

16. Who prepares your lunch? MYSELF=1 WIFE=2 CHILD, OTHER RELATIVE=3 HOUSEKEEPER OR COMPANION=4 NEIGHBOR=5 FEEDING CENTER=6

17. How many days do you usually eat/drink something between noon and the evening meal? 0 1 2 3 4 5 6 7
IF FEWER THAN 4, SKIP TO #20

18. Where do you obtain mid-afternoon snacks? OWN HOME=1 RELATIVE/ FRIEND'S HOME=2 RESTAURANT=3 OTHER (_____)=5 VENDING MACHINE=6

19. Do you eat these snacks-- NO=0 SOMETIMES=1 YES=2
a. because you are hungry?
b. as part of social activity?
c. for something to do?
d. because it looks appetizing?
e. to gain weight?
f. doctor/dietitian advised eating often?
g. feel better to eat frequently?

20. Is an evening meal regularly provided (at least 4 times a week) in your home? YES=2 NO=0

21. Who usually prepares your evening meal? MYSELF=1 WIFE=2 CHILD, OTHER RELATIVE=3 HOUSEKEEPER OR COMPANION=4 NEIGHBOR=5

22. How many days each week do you usually eat a meal in the evening? 0 1 2 3 4 5 6 7

23. How many days a week do you usually eat your evening meals with other family members? 0 1 2 3 4 5 6 7

24. How many days each week do you usually eat or drink something after the evening meal? 0 1 2 3 4 5 6 7
IF FEWER THAN 4, SKIP TO ITEM #26

25. Why do you eat evening snacks? YES=2 SOMETIMES=1 NO=0
a. because you are hungry?
b. as part of social activity?
c. for something to do?
d. because it looks appetizing?
e. to gain weight?
f. doctor/dietitian advised eating often?
g. feel better to eat frequently?
h. helps to sleep better?

26. Do you eat meat? YES=2 NO=0
If not, is it for: RELIGIOUS=1 HUMANITARIAN=2 ECONOMIC=3 PHYSICAL=4 reasons?

27. Do you eat: Eggs? YES=2 NO=0
Milk? YES=2 NO=0
Cheese? YES=2 NO=0

28. a. Have you ever been on a diet to lose weight? YES=2 NO=0
    b. If "Yes," was it prescribed by: PHYSICIAN=1 SELF=2 FRIEND/RELATIVE=3

    Have you ever been on a diet to gain weight? YES=2 NO=0

29. Have you ever been on a "low-salt" diet? YES=2 NO=0

30. Are you on any special diet now?
    a. modified calories HIGH=2 LOW=1
    b. salt
    c. cholesterol/fat
    d. fiber HIGH=2 LOW=1
    e. diabetic INSULIN=1 PILLS=2 DIET=3

31. Do you think your weight is NOW:
    TOO HEAVY=2 TOO LIGHT=0 ABOUT RIGHT=1

32. Do you add salt to your food at the table? USUALLY=2 NEVER=0
    ONLY AFTER TASTING=1

33. Is your diet restricted by any of the following? (Indicate kind of food that is restricted.)

    Difficulty chewing_____ Allergies_____

    Food seems tasteless_____ Cost_____

    Gas_____ Lack of Storage Facility_____

    G.I. cramps_____ Hard to Cook_____

    Constipation_____ Diarrhea_____

    Difficulty getting groceries_____

    Choices offered by others who prepare my food_____

34. Have you ever been treated by a doctor for: YES=2 NO=0

    Diabetes _____
    Heart disease _____
    High blood pressure _____
    Cancer (Kind:_____) _____
    Diverticulosis (or diverticulitis) _____
    Anemia _____
    High blood cholesterol, etc. _____
    Osteoporosis, osteomalacia _____

35. Do you drink alcoholic beverages? REGULARLY=3 OCCASIONALLY=2 NEVER=0

36. Do you smoke? REGULARLY=3 OCCASIONALLY=2 DID BUT NO MORE=1 NEVER=0

37. What is the tallest you ever were? _____ft. _____in.

NUTRITION KNOWLEDGE AND ATTITUDES TOWARDS THE PCENP

1. Date:_____ Interviewer:_____

2. Subject's Name:_____Subject No.:_____

3. Do you enjoy attending the Payne County Elderly Nutrition Program? YES=2 NO=0

4. Why do you attend the Payne County Elderly Nutrition Program? YES=2 SOMETIMES=1 NO=0
   a. because your friends also attend?
   b. because the food tastes so good?
   c. because the meals are affordable?
   d. for something to do?
   e. because the food has good nutritional value?
   f. because it is easier than preparing food at home?

5. How do you feel about the portion size of food served?
   a. too large
   b. too small
   c. ideal

6. Is it worthwhile to donate money for the program? YES=2 NO=0

7. Is it a convenient method of donating money by placing it in envelopes on the table? YES=2 NO=0

8. Would you enjoy learning more about the food served and how it helps your body? YES=2 NO=0

9. Which types of programs do you enjoy most? HIGHLY ACCEPTABLE=2 ACCEPTABLE=1 UNACCEPTABLE=0
   a. films
   b. slides
   c. lecturers
   d. group discussions
   e. television and/or radio
   f. newspapers
   g. pamphlets, brochures
   h. games
   i. others_____

9.5 Name two foods very high in calories: a_____ b_____

10. Name a good source of vitamin A_____

11. Name a good source of vitamin C_____

12. Name a good source of calcium_____

13. Name a good source of iron_____

14. Name a good source of thiamin_____

15. Name the Basic Four_____

ADDITIONAL INFORMATION

1. Do you take advantage of coupons when shopping? YES=2 NO=0

2. Do you take advantage of newspaper or advertising specials for food? YES=2 NO=0

3. Do your present activities include: OFTEN=2 SOMETIMES=1 NEVER=0
   a. housework
   b. gardening
   c. walking
   d. babysitting
   e. hobbies
   f. other (specify)_____

4. Do you enjoy your activities?
   a. daily?
   b. every other day?
   c. weekly?
   d. other (specify)_____

5. Do you belong to any organizations such as: YES=2 NO=0
   a. church groups
   b. charity organizations (i.e., heart fund)
   c. clubs
   d. adult education classes
   e. Senior Citizen Center
   f. other (specify)_____

6. What are your major sources of income?
   a. social security
   b. retirement
   c. welfare
   d. private sources
   e. savings
   f. combination (state letters)_____
   g. other (specify)_____

7. About how much money do you spend for food each week?
   a. $0-$10
   b. $11-$20
   c. $21-$30
   d. $31-$40
   e. $41-$50
   f. more than $50

8. In what state have you lived the longest?_____

9. Which most nearly describes the number of school years you've completed?
   a. less than 4th grade
   b. fourth-eighth grade
   c. ninth-twelfth grade
   d. high school graduate
   e. attended college
   f. college graduate

APPENDIX B

RECOMMENDED DIETARY ALLOWANCES - 1980

TABLE X

RECOMMENDED DIETARY ALLOWANCES,
REVISED 1980 (8)

Nutrients	Female, 51+ Years	Male, 51+ Years
Calories	1800	2400
Protein (gms)	44	56
Calcium (mg)	800	800
Vitamin A (μg Re)	800	1000
Vitamin C (mg)	60	60
Niacin (mg NE)*	13	16
Iron (mg)	10	10
Riboflavin (mg)	1.2	1.4
Thiamin (mg)	1.0	1.2

*NE=niacin equivalent.

APPENDIX C

ANALYSIS OF VARIANCE TABLES

TABLE XI

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO AGE

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	3	211.8522	0.46	0.7126
Protein (gm)	3	773.3082	0.25	0.8620
Calcium (mg)	3	455.0970	0.23	0.8768
Vitamin A (µg RE)	3	42654.599	0.43	0.7339
Vitamin C (mg)	3	7875.2778	1.20	0.3282
Niacin (mg NE)	3	357.4143	0.12	0.9453
Iron (mg)	3	279.3500	0.33	0.8068
Riboflavin (mg)	3	1315.5058	0.12	0.9500
Thiamin (mg)	3	63.8248	0.09	0.9629

TABLE XII

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO SEX

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	1	1271.8020	3.10	0.0883
Protein (gm)	1	8159.2904	2.99	0.0936
Calcium (mg)	1	1615.8515	0.87	0.3594
Vitamin A (µg RE)	1	518965.8800	0.54	0.4666
Vitamin C (mg)	1	14163.70859	2.19	0.1487
Niacin (mg NE)	1	2606.7748	0.98	0.3290
Iron (mg)	1	4.83176	0.01	0.9397
Riboflavin (mg)	1	14031.65987	1.36	0.2516
Thiamin (mg)	1	683.7473	1.10	0.3020

TABLE XIII

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO SOCIAL SECURITY INCOME

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	1	377.7642	0.86	0.3610
Protein (gm)	1	919.9418	0.31	0.5813
Calcium (mg)	1	859.3923	0.45	0.5052
Vitamin A (µg RE)	1	6355056.2678	8.29	0.0072
Vitamin C (mg)	1	53.3079	0.01	0.9306
Niacin (mg NE)	1	5681.3746	2.23	0.1457
Iron (mg)	1	225.7842	0.27	0.6040
Riboflavin (mg)	1	41425.2284	4.41	0.0440
Thiamin (mg)	1	189.5882	0.30	0.5892

TABLE XIV

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO RETIREMENT INCOME

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	1	11.9144	0.03	0.8720
Protein (gm)	1	6.6261	0.00	0.9628
Calcium (mg)	1	1996.3996	1.08	0.3075
Vitamin A (μg RE)	1	38499.3042	0.04	0.8434
Vitamin C (mg)	1	7845.8400	1.18	0.2862
Niacin (mg NE)	1	2943.1842	1.12	0.2991
Iron (mg)	1	2426.9548	3.23	0.0820
Riboflavin (mg)	1	747.4888	0.07	0.7934
Thiamin (mg)	1	222.9055	0.35	0.5580

TABLE XV

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO PRIVATE SOURCES OF INCOME

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	1	2448.7905	6.57	0.0154
Protein (gm)	1	17503.0693	7.22	0.0115
Calcium (mg)	1	10069.2798	6.32	0.0174
Vitamin A (μg RE)	1	82224.4318	0.08	0.7728
Vitamin C (mg)	1	1376.3642	0.20	0.6576
Niacin (mg NE)	1	4350.8649	1.68	0.2048
Iron (mg)	1	1233.8000	1.56	0.2207
Riboflavin (mg)	1	15054.0352	1.47	0.2347
Thiamin (mg)	1	2567.3204	4.77	0.0366

TABLE XVI

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO SAVINGS INCOME

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	1	190.9887	0.43	0.5174
Protein (gm)	1	4054.7857	1.42	0.2428
Calcium (mg)	1	534.0918	0.28	0.5999
Vitamin A (µg RE)	1	54240.9778	0.06	0.8146
Vitamin C (mg)	1	21556.3485	3.47	0.0722
Niacin (mg NE)	1	1.013299	0.00	0.9848
Iron (mg)	1	41.7613	0.05	0.8238
Riboflavin (mg)	1	1500.0019	0.14	0.7105
Thiamin (mg)	1	427.2122	0.68	0.4162

TABLE XVII

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO FOOD BUDGET EXPENDITURES

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	3	1013.2765	0.73	0.5438
Protein (gm)	3	15632.2355	1.89	0.1536
Calcium (mg)	3	7109.4943	1.31	0.2917
Vitamin A (µg RE)	3	437708.8929	1.69	0.1922
Vitamin C (mg)	3	1344.3183	0.06	0.9808
Niacin (mg NE)	3	16479.3935	2.25	0.1041
Iron (mg)	3	3741.0658	1.59	0.2131
Riboflavin (mg)	3	32444.4197	1.05	0.3866
Thiamin (mg)	3	925.0090	0.46	0.7156

TABLE XVIII

ANALYSIS OF VARIANCE FOR NUTRIENTS STUDIED--
RELATED TO EDUCATIONAL BACKGROUND

Source	Degrees of Freedom	Mean Square	F-Value	Observed Significance Level
Calories	4	2516.0514	1.48	0.2362
Protein (gm)	4	24174.000	2.38	0.0765
Calcium (mg)	4	19938.2985	3.55	0.0189
Vitamin A (µg RE)	4	249546.2727	0.65	0.6346
Vitamin C (mg)	4	34742.8375	1.31	0.2925
Niacin (mg NE)	4	12165.9564	1.13	0.3626
Iron (mg)	4	5385.0187	1.79	0.1593
Riboflavin (mg)	4	28693.1564	0.66	0.6238
Thiamin (mg)	4	2749.9633	1.08	0.3843

VITA[2]

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Master of Science

Thesis: NUTRITIONAL ADEQUACY OF THE DIET IN RELATION TO NUTRITION KNOWLEDGE AND TO SELECTED SOCIOECONOMIC AND DEMOGRAPHIC VARIABLES OF THE ELDERLY ATTENDING THE STILLWATER CONGREGATE MEAL SITE

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