BODY COMPOSITION, KNOWLEDGE OF AND ATTITUDES TOWARD NUTRITION, BODY IMAGE AND EXERCISE PATTERNS OF WOMEN AGED SIXTY AND OLDER

A Thesis

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By

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ABSTRACT

The purpose of the study was describe body composition, activity levels, dietary intake and knowledge and attitudes related to nutrition, body image and physical activity of women aged sixty years and older who exercise.

A total of forty-eight volunteers from Victory fitness center participated in the study. The subjects were healthy (had not been hospitalized in the last three months) community dwelling women age sixty to eighty-six years, who exercised at least twice a week.

Anthropometric measurements indicate these women were slightly overweight with a high percent body fat (acceptable 27-34%) and BMI. Fat folds and circumference (AMA) measurements were compared to NHANES data. Mean dietary intake met 100%, except for calcium, of the RDA for women greater than fifty-one years old. Energy intake was low when compared to energy expenditure estimated from Bouchard's three day activity record. Mean scores from questionnaire indicated low level of nutrition knowledge, negative attitudes toward nutrition and a negative body image. However, an adequate level of knowledge about physical activity was observed. As knowledge of nutrition increased, percent body fat, BMI, weight, energy expenditure and body image decreased.

Dedicated to my family

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CHAPTER 1

INTRODUCTION

In the United States the increase in the percentage of the population which is older than sixty years creates a multitude of challenges for the health professionals. Meeting this challenge will require accurate information about activity and dietary patterns, body composition, and knowledge of and attitudes toward nutrition (Kuczmarski, 1989). The older adults' quality of life depends to a great extent on their physical mobility, mental alertness and cognitive function. In addition, self-esteem and independence are also dependent on those capabilities. Studies have shown declines in physical and neurosensory functions with aging (Rosenberg, 1992 et al.).

Age-dependent changes in body composition are very prominent. Decreases in bone density and lean mass combined with an increase in body fat have been correlated with increased incidence of osteoporosis and increase cardiovascular morbidity and mortality (Rosenburg, 1992 et al.; Tsunenari, 1993 et al.). Furthermore, large differences in body fat and fat distribution have been documented in older men and women (Heitmann, 1991). Those who exhibit android obesity (body fat concentrated in upper body and abdomen, typical pattern in males) are at greater risks for cardio-

vascular disease, non insulin-dependent (Type II) diabetes mellitus, hypertension, hyperlipidemia, as well as higher risk of death than those who have gynoid obesity (body fat concentrated in hips and thighs, typical pattern in females) (Lee, 1993). Other body composition changes associated with aging include: loss of skeletal muscle; decrease in number of cells and a moderate decrease in the function of organs; expansion of adipose tissue mass, redistribution of fat from the extremities to the trunk; and maintenance or loss of weight (Kuczmarski, 1989; Baumgartner, 1993 et al.; Evans, 1993).

Previous studies of the older adult have been directed toward negative factors such as, decline, deterioration and disease. It is important to explore positive characteristics of the aging too. This study focused on women, sixty years and older who were active and independent. More specifically, the study measured older women's nutrition knowledge and attitudes toward nutrition and body image; and the effect their dietary intake and exercise activities have on body composition. Participation in a regular exercise program at an optimal intensity and time, appears to increase/maintain muscle strength and endurance (Evans, 1992; Evans, 1993). Other studies have shown that exercise may reverse body composition characteristics associated with a sedentary lifestyle (Schaberg-Lorei, 1990 et al.).

It was **hypothesized** that those participating in regular exercise routines would have an acceptable level of body fat (27-34%) and a positive body image; and would have good foundation in nutrition knowledge and positive attitudes toward nutrition and would consume a balanced diet.

Specific objectives for this study were:

1. Based on bioelectrical impedance analysis (BIA) and anthropometric measurements estimate body fat, lean body mass and body mass index.
2. From three day diet records and three day activity records estimate energy intake and expenditure.
3. Measure knowledge of and attitudes toward nutrition and perception of body image .
4. Examine relationships among the type of exercise(water aerobics, weight training, walking), percent body fat, lean body mass, body weight, nutrition knowledge and attitudes, body image, dietary adequacy and demographic variables.

SIGNIFICANCE OF THE STUDY

Older adults represent a growing proportion of the United States population (Kuczmarski, 1989). Numerous studies have been conducted on this population's dietary intake, knowledge and attitude toward nutrition, body composition and overall health status. However, the majority of the research focused on institutionalized individuals. More research is needed to identify or describe attitudes toward and knowledge of nutrition, body image and dietary intakes of older women who are healthy and physically active.

Results from this study can be used as updated information in the development of standards for nutritional assessment in older women and planning of education and activity programs specifically geared to meet the needs of older women.

LIMITATIONS OF THE STUDY

The following limitations were taken into consideration for this study:

The population used for this study were volunteers from Victory Fitness Center for women and therefore are not necessarily representative of older women of the central Ohio area.

The number of subjects was limited to less than fifty due to time and resources.

Wide age range is more reflective of physical active individuals than age specific.

DEFINITION OF TERMS

Knowledge: the range of one's information or understanding of a science (Poppe, 1992).

Attitude: a mental position with or a feeling or emotion toward a fact or state (Poppe, 1992).

Body image: the positive and negative way one views ones physical appearance (Stevens, 1994 et al.).

Acceptable level of body fat: 27-34% (RJL Systems Inc., Detroit, Michigan)

Recommended Dietary Allowance (RDA): "the levels of intake of essential nutrients that , on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons" (National Research Council, 1989).

Healthy diet: a diet that meets two thirds of the RDA.

Healthy Older Adult: an individual age sixty and older, non-institutionalized, exercises two to three times per week and has not been hospitalized in the last three months.

CHAPTER 2

Review of Literature

Nutritional Status

Nutrition plays a key role in the quantity and quality of life in older adults (Kerstetter, 1993 et al.). The United States Department of Agriculture Human Nutrition Research Center on Aging at Tufts University stresses how a proper diet in the form of adequate protein, minerals and vitamins is required for complete muscle function (Rosenberg, 1992 et al.). It is important to prevent nutrient deficiencies, since they can lead to serious health problems. Even marginal nutrient deficiencies may contribute to morbidity (Kerstetter, 1993). Nutrition can be a contributing factor in various chronic diseases of the older population, such as, cardiovascular disease, hypertension, non-insulin dependent diabetes mellitus and cancer (Thomas, 1990).

There are numerous changes that occur to the body throughout the aging process. A reduced ability to detect the need for fluids has been documented (Morley, 1993). Furthermore, energy expenditure and caloric intakes decrease with the aging process (Kerstetter, 1993).

Older adults are less likely to change their diet, and vegetarian and weight reduction diets among the older adults are uncommon unless prescribed by a doctor (Vetter, 1990 et al.). However, some general

common changes in diet include: older adults tend to increase their consumption of fish while decreasing their overall consumption of meat; older adults increase their fiber intake; and older adults tend to reduce their salt, sugar and fat intake (Vetter, 1990 et al.). There is evidence that older adults tend to have higher lipid intakes and inadequate intakes of essential vitamins (Posner, 1994 et al.). Consuming less than two thirds of the RDA for vitamins is common in this population (Morley, 1993). This is alarming because, nutritional deficiencies may develop from consuming a diet low in food energy or lacking in one or more of the essential nutrients (Poppe, 1992). Nutrient deficiencies are preventable therefore, it is imperative that the nutrient quality and density of older adults' diets are adequate in order to deter a decline in vitamin and mineral intake (Kerstetter, 1993 et al.).

Past research has shown that typical diets of older adults in the United States are low in food energy, iron and folacin (Poppe, 1992). Inadequate intakes of water soluble vitamins, vitamin D, zinc, copper, chromium and water are also common in the older adult population (Kerstetter, 1993 et al.). Evidence of energy, calcium and zinc intakes being below recommended levels has been documented as well (Mahalko, 1985 et al.). Individuals who do not drink milk often have low intakes of calcium, vitamin D and riboflavin (Poppe, 1992). However, there is conflicting evidence out there. Research has shown that all the basic four food groups requirements are met in this population with the exception of diary, dietary calcium, which is less that the recommended daily intake (Fanelli & Abernethy, 1986). Some research has shown no clear physical signs of nutritional deficiencies (Lowik, 1990).

Quality of life for older individuals is dependent on physical mobility, mental alertness and cognitive function (Rosenburg, 1992 et al.). Independence and self esteem are determined by those capabilities. It has been found that continued physical activity and good nutritional status plays a significant role in determining ones physical and cognitive function (Rosenburg, 1992 et al.).

Mild vitamin deficiencies may contribute to the development of decreasing neurocognitive function with aging (Rosenburg, 1992 et al.). Individuals with low blood levels of folate, vitamin B-12, vitamin C and riboflavin score poorly on memory test and nonverbal abstract thinking (Rosenburg, 1992 et al.). Deficiencies of vitamin B-12, vitamin B-6 or folate can have an impact on the nervous system. The main pathological effect on the nervous system is demyelination (Rosenburg, 1992 et al.). Folate deficiency is related to irritability, memory loss, paranoia and psychiatric disorders like, depression, dementia, schizophrenia and epilepsy (Rosenburg, 1992 et al.). Vitamin B-12 deficiency may cause conditions like, paresthesia, ataxia, mood disturbances, delusions and paranoia (Rosenburg, 1992 et al.). Vitamin B-6 deficiency may cause peripheral neuropathy and convulsions.

Other conditions related to nutrient deficiencies are as follows. Cataract is the most common visual disease found in the older adult population. Individuals with an inadequate intake of vitamin C are at higher risk for posterior subscapular and central cataract (Rosenburg, 1992 et al.). A decline in immune function, particularly cellular immunity, has been documented when there is a deficiency in any of the essential nutrients (Rosenburg, 1992 et al.). Protein energy malnutrition has been noted as well (Morley, 1993). Deficiencies in vitamin D and calcium may cause health

conditions such as, osteoporosis. Chronic diseases such as, cardiovascular disease, hypertension, non-insulin dependent diabetes mellitus and cancer are linked to nutrient deficiencies (Thomas, 1990), as well as, hypercholesterolemia (Lowik, 1990 et al.).

Research has shown several gender specific differences in nutrition problems between the older males and females. Older females tend to decrease their food intake more than their male counterparts (Morley, 1993). In addition, their total energy expenditure and resting metabolic rate is also less (Morley, 1993).

It has been documented that older women are more open to taking vitamin or mineral supplements than men are. Furthermore, the older female population is more likely to consume a diet that is less than two thirds of the RDA for vitamins when compared to the males (Morley, 1993). Health problems related to nutrient deficiencies that are more common in the older female population include: protein energy malnutrition; osteoporosis from deficiencies in vitamin D and calcium; and total blood cholesterol levels increase with age, while HDL cholesterol levels decreased (Morley, 1993). The incidence of obesity, hypercholesterolemia and hypertension is higher for older woman than older men (Lowik, 1990 et al.). Type II diabetes mellitus is more prevalent in females less than sixty-five years of age; where as, the incidence is more prevalent in males aged sixty-five and older (Morley, 1993).

It is necessary to assess individual's knowledge of nutrition since, diet has cumulative effects on health status (Thomas, 1990). Nutrition knowledge has been positively correlated to diet quality, years of education and income levels in older adults (Stanek & Sempek, 1990). Also, individuals who do

their own shopping have the highest number of correct responses to nutrition questionnaires (Fanelli & Abernethy, 1986). Research shows that when older adults are asked basic nutrition questions pertaining to eating healthy, the older population knows as much as the younger adults (Vetter, 1990 et al.).

Numerous studies have utilized survey type instruments to assess nutrition knowledge, attitudes and beliefs, dietary habits and intake. The basic components of nutrition questionnaires include: demographic and personal information; food resources; food consumption patterns; dietary practices related to health; activity patterns and nutritional knowledge (Fanelli & Abernethy, 1986). These questionnaires along with diet histories, 24 hour dietary recall, or seven day food records have been successful in assessing total nutrition adequacy in general (Thomas, 1990). When compared to actual serum and plasma levels, diet histories and records are good indicators of dietary iron, protein, zinc, ascorbate and ascorbate supplement levels (Mahalko, 1985 et al.). However, some questionnaires are weak in predicting specific components like individual nutrients and fat composition thus, it is recommended to use at least a 24 hour dietary recall in conjunction with a questionnaire (Thomas, 1990).

In conclusion, modifying dietary intake can improve older adults' sense of wellness and self image, and may also reduce morbidity (Fanelli & Abernethy, 1986). The ideal type of diet for older adults consists of foods from all of the food groups. This type of diet will increase nutrient quality and caloric adequacy (Poppe, 1992).

Physical Activity and Fitness

Health professionals are in agreement that the combination of good nutrition and frequent exercise is a good intervention to many life threatening diseases like, cardiovascular diseases (Parks & Schwartz, 1994). It has been shown that physical activity increases one's life expectancy. Furthermore, age-related alterations in body composition may be a result of low physical activity and improving intake of particular nutrients can slow the onset of debilitating diseases(Parks & Schwartz, 1994). One must be careful when dealing with the elderly. There are numerous arguments to maintain healthy body and to increase physical activity; however, most older adults primary source of pleasure is eating (Parks & Schwartz, 1994). Thus, if their comfort foods are eliminated, stress and depression may occur (Parks & Schwartz, 1994). Implementing the concept that there is no such thing as good or bad foods is one suggestion. Successfully conveying this message is important to the older population. It gives nutrition professionals a chance to improve the older population's quality of life by changing older adults physical fitness and good nutrition behaviors (Parks & Schwartz, 1994).

Research has examined the changes of aging and the role that exercise, both dynamic and resistive, positively plays in affecting age-induced degeneration such as, severe dementia or global cerebrovascular disease (Lowenthal, 1994 et al.). Dynamic exercise and low-level strength training can reverse the onset of diseases such as, hypertension, diabetes mellitus and ischemic heart disease. Furthermore, exercise can make it easier for health professionals to treat these conditions (Lowenthal, 1994 et al.)

Bone loss is also very common among the aged. The rate of the loss is dependent on the individual; however, it is more rapid in postmenopausal

women. This decrease in bone mass, osteoporosis, reduces body stature and increases the chance for fractures (Lowenthal, 1994 et al.). Resistance training increases ones skeletal muscle strength and endurance. Also, dynamic weight bearing and strength conditioning exercise can slow down the rate of bone mass loss and reverse skeletal muscle atrophy(Lowenthal, 1994 et al.). Data show that a six to fifty-two week strength training program of older persons can decrease individual's body weight and percent body fat and increase individual's lean body mass (Lowenthal, 1994 et al.).

In the older population aerobic exercise can reduce the risk factors for hypertension, triglycerides, cholesterol, glucose tolerance, obesity, insulin sensitivity and platelet aggregation for coronary artery disease (Lowenthal, 1994 et al.). A dynamic exercise program lasting two to twelve months of older adults has documented a 15-30 % increase in individual's VO2 max. (Lowenthal, 1994 et al.). More specifically habitual exercise can increase maximal oxygen uptake and cardiac output, reduce blood pressure, produce a more efficient heart muscle, increase the HDL-LDL ratio, reduces platelet aggregation, counteracts osteoporosis and normalizes glucose tolerance (Astrand, 1992).

Research shows that in older populations a combined aerobic exercise and strength/resistive training program can increase an individuals' daily expenditure and can preserve or increase the individuals' lean body mass. Improvement in bone mineral density and ambulation among older persons has also been noted (Kendrick, 1994 et al.). Post menopausal women who also participate in aerobic exercise along with a light resistive muscular

endurance program have a decrease in percent body mass, fat weight and fat fold measurements along with an increase in lean body mass (Schaberg-Lorei, 1990 et al.).

Regular physical exercise requires changes in vitamin and mineral intake, which compensates for the loss of minerals in sweat and for increases in metabolism (Kendrick, 1994 et al.). It has been suggested that the exercising older adult population's protein intake needs to be one gram/ kilogram of body weight and an individual's calcium intake needs to be 1200-1500 mg/day (Kendrick, 1994 et al.). Furthermore, fluid intake needs to be monitored, since the elderly commonly exhibit a decline in thirst response to low fluid levels. This will avoid dehydration(Kendrick, 1994 et al.). Vitamin E supplementation in older adults can improve the rate of muscle repair after exercise that resulted in muscle damage (Evans, 1992).

In conclusion, aging has been found to be associated with reduced maximal aerobic power and muscle strength with a declined in physical fitness. Physical training can improve the human body function (Astrand, 1992). From a nutritional view point, physical activity increases the metabolic rate thus, higher energy intakes can guarantee an adequate intake of essential nutrients. Habitual physical activity can increase ones maximal aerobic power, muscle strength and endurance (Astrand, 1992).

Body Composition Assessment

There are numerous reasons to collect body composition data in older adults. Establishing energy stores and protein mass, finding out skeletal mineral status, and obtaining a reference base for energy expenditure and hydration are to name a few (Heymsfield, 1989 et al.). Health professionals

believe the true definition of fitness or obesity can be found with an accurate calculation of percent body fat (Reilly, 1993 et al.). Aging can usually be described by : decreased fat free mass via muscle mass or bone mineral loss; reproportioning of body fat causing a shift from subcutaneous depots to increased deposition of body fat in internal fat depots (Reilly, 1993 et al.).

There has been new advances in body composition among the older population. The focus is on neutron activation analysis, neutron inelastic scattering and dual photon absorptometry (Heymsfield, 1989 et al.). The implications of the newly developed methods are that they are not dependent on the aging process, as are more common methods (Heymsfield, 1989 et al.). The implementation of these new methods can only strengthen the research field.

Dual energy x-ray absorptometry can be used to measure bone mineral content, fat and lean body mass (Tsunenari, 1993 et al.). Evidence shows a difference between women who exercise and those who do not. Findings from these measurements show that fat decreases with age and soft tissue mass increases with age in older women who exercise (Ricco, 1993 et al.). In older women who exercise findings indicate that water levels are lower and there is not any differences in bone mineral components (Ricco, 1993 et al.). The decline in fat, increase in soft tissues and the absence of changes in mineral component is attributed to exercising and eating healthy (Ricco, 1993 et al.). In older women who do not exercise, research shows that bone mass content declines with age more than in males, and there is a strong correlation with bone mineral content and fat (Tsunenari, 1993 et al.).

Research has shown that age dependent changes in the body composition of the older population like, bone mass, lean body mass and fat

mass can also be accurately assessed using a combination of BIA, anthropometric measurements, BMI or prediction equations (Visser, 1993 et al.).

Bioelectrical impedance analysis (BIA) is a good tool to use with older adults. BIA measures the electrolyte content and conductivity of fat free mass. From this information estimates of body composition can be made (Chumlea, 1993 et al.). Most studies of BIA use whole body resistance and reactance. The measurements are taken from the wrist to the ankle at 800 mA 50KHz current (Chumlea, 1993 et al.). The data determines volume of total body water or fat free mass and sometimes extracellular water and fat free mass for both men and women (Chumlea, 1993 et al.). The use of BIA in the older population to estimate body composition validity has not been clearly established, except for small samples with limited age ranges (Reilly, 1993 et al.).

The use of age specific equations in conjunction with whole body BIA has been suggested as an alternative method to use with older adults to estimate body composition (Reilly, 1993 et al.). Using an age specific equation is necessary, because most systematic equations are based on younger populations; therefore, if used, can give an over estimation of fat free mass (Reilly, 1993 et al.). Studies have shown that equations with age as an independent continuous variable are more accurate in estimating percent body fat than other prediction equations (Visser, 1994 et al.). The age specific equation that is commonly used to estimate fat free mass is ($FFM(kg)=(.671*10^4*H^2/R)+(3.15*S)+(3.9)$). Research has shown that when compared to densitometry BIA over estimates body fatness (Reilly, 1993 et al.).

BIA of body segments has also been suggested as an alternative method to use with older adults to estimate body composition. Studies show that impedance index for the arm predicts whole body fat free mass accurately (Chumlea, 1993 et al.). It has been reported that the use of BIA at 50 KHz has limitations, because the body is a heterogeneous ionic conductor with a complex geometrical shape that is pronounced with the aging process; however, measures at lower or higher frequencies discipher the proportions of intra and extracellular fluid levels in older adults (Chumlea, 1993 et al.).

Studies have also assessed the accuracy of the two electrode BIA method of determining fat free mass. When compared to underwater weighing, the two electrode impedance method is a reliable and valid approach to use with older adults (Boulier, 1990 et al.).

The estimation of body density from fat fold measurements for the most part works well with older adults. Commonly used fat fold sites are the biceps, triceps, suprailiac and subscapular (Reilly, 1993 et al.; Visser, 1994 et al.). Some studies have shown a high estimation of body density among older females when fat folds are used (Reilly, 1993 et al.). However, research has also documented that all the fat folds are significantly correlated with body density. Findings show that prediction equations using fat folds are more accurate in estimating percent body fat than other prediction equations (Visser, 1994 et al.). In both genders the suprailiac fat fold has the strongest correlation with body density. In addition, equations comprising of independent variables like, sex, sum of triceps, biceps, subscapular and suprailiac are good predictors of body density and valid to use with the older population (Visser, 1994 et al.).

Body mass index (BMI) is another method used to predict body density. The prediction equation used with BMI to estimate body fat percent is BF%=(1.2*BMI)-(10.8*sex)+(.23*age)-5.4) (Reilly, 1993 et al.). Studies show that in females the percent body fat estimates are highly correlated with body fat percent by densitometry; however, age specific equations in some research over estimates body fatness when compared to densitometry (Reilly, 1993 et al.). Research has also shown that BMI is larger in women than men, and equations using sex and BMI as independent variables give an accurate estimation of body density and valid to use with the older population (Deurenberg, 1991et al.; Visser, 1994 et al.). Lastly, the prediction equations error is in line with other methods like fat fold measurements or BIA (Deurenberg, 1991 et al.).

Circumference measurement is another method to assess body fat and fat distribution. The commonly used measurement sites are at the waist and hip. A waist-to- hip ratio is calculated and used to identify individuals who are at risk to develop diseases (Heitmann, 1991 et al.). Findings indicate large differences in total body fat between the sexes. Body fat percentages increase more in women with age than men. Waist-to-hip ratios are larger in women than men, which suggests that waist-to-hip ratio as an indicator of cardiovascular risk is gender specific (Heitmann, 1991). Research has also revealed that prediction formulas with circumference measurements are not as accurate in estimating body density in older adults as other equations that use fat fold measurements or BMI (Visser, 1994 et al.).

Siri's equation {BF%=(1.2*BMI)-(10.8*sex)+(.23*age)-5.4)} to convert body density to body fat is typically used, but not only used, with underwater weighing (Reilly, 1993 et al.). Studies show that Siri's equation

used to estimate body fat percent in older female adults results in an over estimation of body fat content. This is attributed to the fact that older female's body density is typically lower than 1.100 lkg/m3, which is the result of a higher proportion of body fat (Visser, 1994 et al.; Reilly, 1993 et al.). Some studies have modified the equation (BF%=(512.1/density)-469) to correct this problem. The results indicate a high correlation with other methods of estimating body fat percent in older females (Reilly, 1993 et al.). The use of Siri's equation in conjunction with the equation Durnin and Womersley (1974) uses to estimate body density {body density(g/ml)= 1.1423-(.0632*log(x_3)) where x_3=sum of triceps, biceps, suprailiac and subscapular fat folds} has proven to be successful in estimating body fat percent.

Height and knee-height indexes have been compared to data from BIA and BMI to see if height can accurately describe the loss of fat free mass that is seen in the older population (Deurenberg, 1991 et al.; Roubenoff & Wilson, 1993). Data suggest that knee height in place of height should be used in comparing body composition across age groups. When examining older populations knee height should be used to adjust body composition measurements when BIA is used (Roubenoff & Wilson, 1993). There is not a significant correlation with BMI and height in older adults, and body fat percent is negatively correlated with body with body height (Deurenberg, 1991 et al.).

In the aged, a decrease in height occurs due to spinal deformity and thinning of the interverebral discs; therefore, it is essential that one chooses an accurate measurement of height (Haboubi, 1990 et al.). Studies compare long-bone measurements in erect and supine positions with the subjects'

heights to see which measurements may be used to accurately predict height. The measurements of total standing height, knee to floor height and tibial length are typically taken, and in both the erect and supine positions measurements of total arm, upper arm and forearm are also taken. The findings show that supine total arm length, knee to floor height and erect forearm length have a strong correlation with measured height (Haboubi, 1990).

In conclusion, it is necessary to collect data on body composition of older female adults. The data base for this population is limited, and much can be learned and gained from knowledge of body composition results pertaining to nutritional status, physical health and morbidity.

CHAPTER 3

MATERIALS AND METHODS

This study focused on women aged sixty years and older who were active and community dwelling. Specifically, the study investigated knowledge of nutrition, attitudes toward nutrition and exercise and body image; body fat, dietary intake, physical activities level and relationships among variables. This study was approved by the Ohio State University Human Subjects Review Board (Appendix A).

Research Design

This investigation is descriptive in nature. It describes the body composition of exercising older women via fat folds, bioelectrical impedance analysis (BIA), height, knee-height, weight, elbow breadth, body circumferences and BMI. Nutrition and exercise knowledge and attitudes and body image are also measured by a questionnaire and dietary intake is assessed from a three day dietary record. Activity level is measured using a three day activity record.

Population

Subjects were recruited from Victory Fitness Center, the all women's location. The researcher visited the center's water aerobic classes and gave a

brief description of what the study was about and a sign up sheet with a description of the study was placed on the wall of the locker room (Appendix B).

A total of forty-eight volunteers participated in this study. The subjects are community dwelling women aged sixty to eighty-six years, who exercise at least twice a week at the center or at home, participating in various activities such as, water aerobics, land aerobics, weight bearing exercise, stationary bike, treadmill and walking. These women have not been hospitalized in the last three months.

Data Collection

Collection of the data took place in a private room in the rear of Victory Fitness Center's locker room. Upon arrival the study was described and subject responsibility outlined to each participant, and informed consent form signed (Appendix C). Then the researcher obtained from the subjects their demographic and personal information (Appendix D). Next, anthropometric measurements were taken on the right side of the body using standardized techniques (Lohman's, 1988) in the following order: height; weight; breadth measurements of wrist, elbow and ankle; circumference measurements of arm, waist and hip; fat fold measurements of triceps, biceps, subscapular and suprailiac; and knee-height (Appendix E). Each measurement was repeated three times.

Body composition was measured via BIA. BIA was performed on all subjects using the standardized procedures of RJL Systems, Inc. (BIA-Model 101, RJL Systems, Inc., Detroit, Michigan). One measurement was taken. The fat fold measurements were taken three times at the following sites:

(1) triceps, mid-point between the acromion process and the olecranon process; (2) biceps, at the same level as the triceps fat fold, directly above center of the cubital fossa; (3) subscapular, about 20mm below the tip of the scapula, at an angle of 450 to the lateral side of the body; (4) suprailiac, just above the iliac crest, in the axillary line. All measurements were taken on the right side of the body.

Development of Knowledge and Attitude Instrument

The subjects filled out a modified version of Fanelli (1986), Thomas (1990), and Poppe (1992) nutrition knowledge, attitude and body image Stevens (1994) questionnaires. The fourth and final version of the questionnaire consists of three sections: (a) nutrition knowledge (b) nutrition attitudes and (c) body image and activity (Appendix F). Questions had been previously tested for reliability (Mitchell, personal communication, 1995). The questionnaire was reviewed by a five member expert-panel for content reliability and then pilot tested on three older adults from the community. Minor changes were made in the wording of some of the questions for clarity. A score of seventy percent on the questionnaire indicates an adequate level of nutrition knowledge and positive attitudes toward nutrition, body image and knowledge of physical activity. The subjects took approximately fifteen minutes to answer the questionnaire which consisted of fifty questions. The researcher was present to answer questions and to encourage completion of the questionnaire.

Lastly, the subjects were given and instructed in completion of the three day dietary record that included supplement use and Bouchard's three day activity record (1983). They were given the phone number of the

researcher if any questions came up (Appendix G). The researcher reviewed the packet with each subject to explain how to keep accurate and complete records and answer any questions. All subjects were given three weeks to complete and return the records. After two weeks the researcher did follow-up calls in insure the completeness by answering any questions and the return of the records by confirming the return date with each subject.

Data Coding

The researcher coded all the data and it was entered into the computer for analysis using Excel software.

Nutrition Knowledge, Attitudes and Body Image

For computer entry the questionnaires' responses were coded (Appendix H) one to five. Five indicated the most correct answer or answer most positive toward nutrition, where as, one represented the least correct answer or least positive toward nutrition.

Body Fat and Lean Body Mass

The RJL Systems, Inc., Bioelectrical Impedance Model 101 was used to estimate percent body fat and lean body mass from its readings of impedance and reactance.

Data from the fat folds were used to estimate body density, percent body fat and lean body mass, using Durnin and Womersley's methods (1974).

1. body density(g/ml)= $1.1423-\{.0632*\log(x_3)\}$

where x_3=sum of triceps, biceps, suprailiac and subscapular fat folds

then use Siri equation:

2. percent body fat={(4.95/density)-4.50}*100

then estimate lean body mass:

3. fat weight= measured body weight * percent body fat

   lean body mass= measured body weight - fat weight

Body mass index was calculated using Quetelet's index (Lee & Nieman, 1993): BMI= weight(kg)/height(m^2). Body mass index was also used to estimate percent body fat and lean body mass (Deurenberg, 1991 et al.).

1. percent body fat= {(1.2*BMI) - (10.8*0) + (.23*AGE) - 5.4}

   where 0= female, 1= male

2. see step three above.

Body mass index was also an indicator of individuals who are over-weight (Stevens, 1994 et al.).

BMI > 27.3 kg/m^2 = Over Weight

Circumference measurements were used to calculate arm muscle area and waist to hip ratio (Lee & Nieman, 1993).

1. arm muscle area(mm^2)=

   $\{MAMC(mm) - (3.14 * \text{triceps skin fold}(mm))\}^2 / 4 * 3.14$

2. waist to hip ratio= waist(cm) / hip(cm)

Weight, Height and Frame Size

Weight (Lee & Nieman, 1993) and height (Chumlea, 1985 et al.) was estimated from knee height measurements.

1. Caucasian women weight(kg)=(knee ht(cm)*1.09)+(mac(cm)*2.68)-65.51

   Black women weight(kg)=(knee ht(cm)*1.5)+(mac(cm)*2.58)-84.22
2. height(cm)={1.83*knee height(cm)}-{.24*age(yr.)}+84.88

Elbow breadth(mm) in conjunction with height(in) was used to determine ones frame size (Lee & Nieman, 1993).

Energy Expenditure

Three day activity record was used to estimate energy expenditure. Bouchard's(1983) methods and procedures were used to calculate energy expenditure. MIN was used for the calculations. MIN values were as follows: (1)= 1.0; (average of 2 and 3)= 1.5; (4)= 2.0; (5)= 2.3; (6)= 3.0; (7)= 4.0; (8)= 5.0; (9)= 6.0 (Appendix G).

The Harris Benedict Equation was used to calculate resting energy expenditure. To get an estimate of twenty-four hour energy expenditure, the REE was increased by 10% to account for the thermal effect of food and then multiplied by an activity factor of 1.75 (average activity) to account for the thermal effect of exercise (Lee & Nieman, 1993). Energy expenditure was compared to the energy values from the dietary and activity records.

Harris Benedict Equation:

REE(Kcal)+ 447.593+3.098(ht(cm))+9.247(wt(kg))-4.33(age)

Dietary Intake

The three day dietary record was analyzed for energy and nutrient content using the Food Processor 2 (1990). Energy and nutrient intakes were compared to the 1989 RDA for women aged fifty-one and older.

Data Analysis

Statistical analysis using Excel software was done. Basic descriptive statistics included: means standard deviations, ranges, frequencies and percents. Data was then quartiled by age and in some case by age and race. Pearson correlations were performed to identify relationships between anthropometric measurements, energy expenditure estimations, nutrient intakes and scores on the attitude, knowledge, body image and physical activity statements.

CHAPTER 4

RESULTS

The purpose of the study was to describe body composition, activity levels, dietary intake and knowledge of nutrition and attitudes toward nutrition, body image, physical activity, nutrition and eating patterns of women aged sixty and older who exercise. The data analysis for the study consisted of anthropometric measurements and of responses to questions related to personal and demographic information, to nutrition knowledge, attitudes, body image, physical activity and three day dietary and three day activity records.

DESCRIPTION OF POPULATION

A total of forty-eight subjects participated in the study. Description of the study population appears in table one. Forty-two Caucasian and six African American women, ranging in age from sixty to eighty-six years old. The average age was 68.9±5.8 years. Twenty-three of the women were married, ten widowed, nine divorced and six single. In regards to residential status only half of the subjects lived alone and forty-five of the participants did their own shopping and cooking and only two participated in congregate meal programs. Thirty-one lived in houses, eleven in apartments, four in condos and two in retirement communities.

Eleven of the participants had greater than sixteen years of education, twenty-seven had thirteen to sixteen years and ten had nine to twelve years. The employment status of the participants were as follows twenty-one retired, twenty-two volunteered, three part time and two full time workers. The average working hours per week was 6.35 ± 10.6 hours. Thirty-five of the subjects perceived their work activity as active.

Twenty-eight of the participants reported medical problems which included: thirteen high blood pressure, nine high cholesterol, five cardiovascular disease, eight arthritis, two diabetes, two osteoporosis, one thyroid, one fibromyalsia, one Crohn's diseases and one Parkinson's disease.

Variables		n
Age		48
	Range 60-86	
Marital Status		
	Single	6
	Married	23
	Divorced	9
	Widowed	10
Ethnic Background		
	Caucasian	42
	African American	6
Residence		
	House	31
	Apartment	11
	Condo	4
	Retirement Community	2
Live Alone ?		
	Yes	24
	No	24
Shopper		
	Self	45
	Roommate	3
Cooking		
	Self	45
	Roommate	3
Congregate Meal Program		
	Yes	2
	No	46
Education (years)		
	9-12	10
	13-16	27
	> 16	11
Employment Status		
	Retired	21
	Volunteer	22
	Part Time	3
	Full Time	2
Perceived Work Activity		
	Active	35
	Sedentary	13
Medical Problems ?		
	Yes	28
	No	20
Self Reported Conditions		
	HBP	13
	HCHOL	9
	CVD	5
	Arthritis	8
	Diabetes	2
	Thyroid	1
	Osteoporosis	2
	Fibro Myalsia	1
	Crohn's Disease	1
	Parkinson's Disease	1

Table 1 Description of Population
Demographic and Personal Information
N= 48

Type and frequency of exercise activity of the subjects ranged between one to three times per month and three to five times per week for each activity (Table 2). Some subjects participated in more than one exercise activity that was why one to three times per month category was added. The majority (43) participated in walking. Thirty-six participants weight trained and thirty-one took water aerobic classes. Twenty-nine rode stationary bikes and twenty-three walked on motorized treadmills. Ten took land aerobic classes and nine did laps in the pool periodically. Activity levels were defined by the reported frequency of exercise. Individuals who exercised 3-5x/week were classified as very active. Individuals who exercised 1-2x/week moderately active. The majority of the sample (43) was classified as very active based on reported frequency of exercise.

Exercise	Frequency and Number of Participants			
Activities	3-5x/week	1-2x/week	1-3x/month	Never
Land Aerobics	3	4	3	38
Water Aerobics	14	13	4	17
Weight Training (machines/free weights)	19	13	4	12
Stationary Bike	15	8	6	19
Treadmill	11	10	2	25
Step Machine	0	4	3	41
Skywalker	2	3	2	41
Walking	27	11	5	5
Swimming	2	5	2	39
Dancing	1	4	0	43
Bowling	0	3	0	45

Table 2 Exercise Activities
Frequency and Number of Participants for Each Activity
N= 48

ANTHROPOMETRIC DATA

The mean scores and standard deviations for the fat folds appear in Table 3 were: triceps 28.7 $\pm$ 9 mm; biceps 18.5 $\pm$ 7.6 mm; suprailiac 27.9 $\pm$

9 mm; and subscapular 25.6 ± 8.4 mm. The mean for the mid arm muscle circumference was 32.1 ± 5 cm. The average waist circumference was 89.4 ± 14 cm, and the average hip circumference was 108 ± 12.6 cm. The mean knee height was 48.4 ± 2.3 cm. The mean for the calculated arm muscle area was 298.6 ± 171.1 mm^2, and the mean for waist to hip ratio was .8 ± .08. The WHR is an index of regional body fat distribution and a guide to assessing health risk (Lee & Nieman, 1993). The WHR for this sample suggested that the population had a moderate risk for coronary artery disease.

		FAT	FOLDS			CIRCUMFERENCES				KNEE
	TSF	BSF	SUPRA	SUBSC	MAMC	AMA	WAIST	HIP	WHR	HEIGHT
MEAN	28.7	18.5	27.9	25.6	32.1	298.6	89.4	108	0.8	48.4
STD	7.0	7.6	9.0	8.4	5.0	171.1	14.0	12.6	.08	2.3

TABLE 3 Anthropometric Data
Means and Standard Deviations
Units: Fat Folds (mm)
MAMC, Waist, Hip, Knee Height (cm)
AMA (mm^2)

The study population was compared to the percentiles from the second NHANES for triceps fat fold, subscapular fat fold and arm muscle area (Lee, 1993 et al.). Results for these women for the triceps fat fold were broken down into two age groups, 55-64 and 65-74 years (Table 4). The mean for the 55-64 year group was 27.8 mm, which puts this group in the 50th percentile. The mean for the 65-74 year group was 29 mm, which puts this group in the 75th percentile. The data was broken down further by race. Caucasians in the 55-64 year group's mean was 27.1 mm (50th percentile), and the 65-74 year group's mean was 28.9 mm (75th percentile). The

African American 55-64 year group's mean was 31 mm and the 65-74 year group's mean was 30 mm, which places both groups in the 50th percentiles.

	TRICEPS FAT FOLD		PERCENTILES	
	Std. Mean	Mean	50th	75th
Population				
55-64	27.2	27.8	26.5	*
65-74	25.7	29	*	31
Caucasians				
55-64	27	27.1	26	*
65-74	25.5	28.9	*	30.5
African Am.				
55-64	29.5	31	28.5	*
65-74	29	30	29	*

TABLE 4 Triceps Fat Fold Means Compared to Standard Means and Percentiles
Units: Age (years)
Fat Fold (mm)

The means for the subscapular measurements are as follows (Table 5). The mean for the 55-64 year group was 22.4 mm, which places the group in the 50th percentile. The 65-74 year group's mean was 26.7 mm (75th percentile). The Caucasians 55-64 year group's mean was 21 mm (50th percentile), and the 65-74 year group's mean was 26.5 mm (25th percentile). The African American 55-64 year group's mean was 29.5 mm (50th percentile), and the 65-74 year group's mean was 28 mm (25th percentile).

	SUBSCAPULAR FAT FOLD		PERCENTILES		
	Std. Mean	Mean	25th	50th	75th
Population					
55-64	23.7	22.4	*	22	*
65-74	22.3	26.7	*	*	30
Caucasians					
55-64	23	21	*	21.5	*
65-74	21.8	26.5	29.5	*	*
African Am.					
55-64	30	29.5	*	31	*
65-74	27.1	28	*	27	*

TABLE 5 Subscapular Fat Fold Means Compared to Standard Means and Percentiles
Units: Age (years)
Fat Fold (mm)

Both the triceps and subscapular fat folds when compared to the norms from the NHANES indicates the total study population fell with in the 25-75th percentiles, classifying the sample as average. When the sample was divided into groups based on age and race there was not a change in the classification. This suggest the sample had adequate fat stores.

The arm muscle area was broken down into three age groups, 60-64, 65-69.9, and 70 and older (Table 6). The mean for the 60-64 year group was 269.1 mm^2 which places the group in the 15th percentile. The 65-69.9 year group's mean was 302.9 mm^2 (25th percentile). The mean for the 70 and older group was 297.6 mm^2 (25th percentile). The mean arm muscle area classified the sample as average (15th-25th percentiles) when compared to the NHANES data. A difference was not found when the sample population was grouped by age. Results indicate that the sample has adequate muscle protein reserves. The lower percentiles (15th-25th) when compared to fat folds (25th-75th) may reflect age related body changes like a decrease in lean body mass and an increase in body fat.

	ARM MUSCLE AREA		PERCENTILES	
	Std. Mean	Mean	15th	25th
Population				
60-64	363	269.1	263	*
65-69.9	363	302.9	*	289
70+	360	297.6	*	288

TABLE 6 Arm Muscle Area Means Compared to Standard Means and Percentiles
Units: Age (years)
AMA (mm^2)

Percent body fat was calculated via three methods: BIA, fat folds and BMI. The average body fat percentage calculated from BIA was 34.6 $\pm$ 5%. The mean percent body fat from the fat folds of triceps, biceps, suprailiac and subscapular was 36.8 $\pm$ 3.9%. BMI calculated mean percent body fat as 44.8 $\pm$ 7.2% (Table 7). Correlations were done to compare the three methods of estimating body fat percent (Table 8). All three methods were significant ($p < .05$): BIA and fat folds at .46; BIA and BMI at .64; and fat folds and BMI at .52. BMI overestimated percent body fat when compared to the other two estimations. This can be attributed to the fact that BMI was to general. It was based on calculations not actual measurements and equation not validated for the study population's age. There was a 2.2% difference between percent body fat estimated from BIA and fat folds. These estimations were used in assessing the population and identifying relationships with other variables in the study. The acceptable level of percent body fat was defined as 27-34%, which indicated the sample had a high percent body fat.

	BIA		FAT FOLDS		BMI	
	%BF	LBM (lb.)	%BF	LBM (lb.)	%BF	LBM (lb.)
MEAN	34.6	65.4	36.8	97.0	44.8	83.5
STD	5.0	5.0	3.9	16.4	7.2	8.9

TABLE 7 Body Composition
Three methods of estimating body fat percent

	CORRELATED VARIABLES	
	FAT FOLDS BF%	BMI BF%
BIA BF%	0.46	0.64
FAT FOLDS BF%	*	0.52
BMI BF%	0.52	*

TABLE 8 Comparison of Methods for Estimating Body Fat Percent
Values are significant at the .05 confidence level.

BMI was also used to determine if the subject was over weight (Stevens, 1994). A BMI greater than 27.3 kg/m^2 indicates over weight. The average BMI was 28.6 ± 5.8 kg/m^2 which indicated a slightly overweight population (Table 9). Fifty percent of the population was overweight. Furthermore, the BMI indicated that the sample was at moderate risk of death from cancer, heart disease and diabetes mellitus.

	BMI (kg/m^2)	Over Weight? yes/no
Standard	> 27.3	**yes**
MEAN	28.6	**yes**
STD	5.8	*********

TABLE 9 BMI Indicator of Over Weight

The mean perceived weight of the study population was 150.0 ± 27.2 lb., where as, the mean actual weight was 155.1 ± 33.2 lb.. Weight was also calculated from knee height. The mean weight was 160.6 ± 31.2 lb. (Table 10).

	Perceived Weight (lb.)	Actual Weight (lb.)	Knee Height Calculated Wt. (lb.)
MEAN	150.3	155.1	160.6
STD	27.2	33.2	31.2

TABLE 10 Three methods of estimating weight

A t-test for paired samples was done on the perceived and actual weight. The result was .03 significantly different ($p<.05$). This indicated that the sample underestimated their weight.

The mean perceived height of the population was 63.3 ± 3.4 inches and mean actual height was 62.7 ± 2.5 inches. The mean height calculated from knee height was 61.7 ± 1.8 inches (Table 11). KH was a good indicator of height. It only underestimated height by one inch. A t-test for paired samples was done on the perceived height and actual height. The result was .098 not significantly different ($p<.05$).

	Perceived Height (in)	Actual Height (in)	Knee Height Calculated Ht. (in)
MEAN	63.3	62.7	61.7
STD	3.4	2.5	1.8

TABLE 11 Three methods of estimating height

A sample mean weight of 155.1+33.2 lb. and mean height of 62.7+2.5 in. indicated the study population was slightly overweight when compared to the reference (119-152 lb.) from the Nutrition and Your Health: Dietary Guidelines for Americans height-weight table (Lee & Nieman, 1993). These results were supported by the findings from BMI which also indicated a slightly overweight population.

The mean and standard deviation for breadth measurements were ankle 6.2 ± .3 cm; wrist 5 ± .3 cm; and elbow 6.2 ± .4 cm. Correlations were done among the breadth measurements and percent body fat from BIA. Wrist breadth and percent body fat was .34 significant at the .05 confidence level. The elbow breadth and percent body fat was .42 significant at the .05 confidence level (Table 12).

BREADTH MEASUREMENTS	MEAN	STD	% BF (BIA) CORRELATIONS
Ankle (cm)	6.2	0.3	.22
Wrist (cm)	5.0	0.3	**.34**
Elbow (cm)	6.2	0.4	**.42**

TABLE 12 Breadth Measurements
Correlations in bold indicate significant relationships at .05 confidence level

Data also showed that the majority (27) of participants had a medium frame size, eighteen had small frames and three had large frame sizes based on elbow breadth and height.

ENERGY

Energy was estimated via three methods: (1) Harris Benedict equation, (2) Bouchard's three day activity record and from the (3) three day dietary records. The Harris Benedict equation estimated mean twenty-four hour energy expenditure as 2491.5 ± 150.1 Kcal. Bouchard's activity record estimated mean energy expenditure MIN as 2755 ± 574 Kcal. Energy expenditure estimations from both methods were within 10% of each other. The mean energy intake from the diet records were 1884 ± 552 Kcal (Table 13).

	POPULATION QUARTILED BY AGE (years)									
	60-64		65-68		69-74		75-86		GROUP	
Kcal	**Mean**	STD	**Mean**	STD	**Mean**	STD	**Mean**	STD	**Mean**	STD
Harris B	**2452**	104	**2601**	160	**2499**	124	**2372**	210	**2491**	150
3d Diet R	**1997**	379	**1787**	437	**1967**	611	**1851**	616	**1884**	552
Bouchard Min	**2621**	434	**3048**	673	**2686**	369	**2617**	761	**2755**	574

Table 13 Energy
Means are in kilocalories

Energy intake compared to estimations of expenditure was 24-32% less than energy expenditure. Findings suggested that energy intake was not sufficient, which conflicted with the findings that the sample was over weight.

DIETARY INTAKES

As a group dietary intakes provided two thirds of the 1989 RDA for all nutrients, thus, dietary intakes were nutritionally adequate. As a group 100% of the RDA was met and exceeded for all nutrients except for vitamin E and zinc. In addition to vitamin E and zinc, when the sample population was quartiled by age the 65-68 and 75-86 year groups did not meet 100% of the RDA for calcium. The mean intakes for the selected dietary components were: energy 1884 Kcal; protein 84.7 g; total fat 65 g; calcium 833 mg; vitamin C 153 mg; vitamin E 6.68 mg; zinc 10.5 mg; and beta carotene 704 RE (Table 14). The selection of these particular dietary components was based on relevance to the population (i.e.. calcium and osteoporosis).

																	TOTAL POP.	
	AGE 60-64 (n=12)				AGE 65-68 (n=13)				AGE 69-74 (n=14)				AGE 75-86 (n=9)				(N=48)	
Dietary				1989				1989				1989				1989		2/3
Components	MIN	MAX	**MEAN**	RDA	MIN	MAX	**MEAN**	RDA	MIN	MAX	**MEAN**	RDA	MIN	MAX	**MEAN**	RDA	**MEAN**	RDA
Energy (kcal)	1491	2907	**1997**	*	876	2426	**1787**	*	1229	3203	**1967**	*	1035	3154	**1851**	*	**1884**	*
Protein (g)	61.3	116	**81.1**	50	41.7	104	**73.5**	50	42	132	**86.7**	50	51.3	145	**88.8**	50	**84.7**	YES
Total Fat (g)	37.3	117	**64.4**	*	34	110	**66.2**	*	28.9	150	**73.1**	*	22.2	87	**61.9**	*	**65**	*
Calcium (mg)	535	1797	**1009**	800	171	1312	**796**	800	291	1511	**830**	800	336	1640	**791**	800	**833**	YES
Vitamin C (mg)	38	413	**175**	60	8.9	323	**154**	60	37.7	384	**160**	60	65.3	268	**142**	60	**153**	YES
Vitamin E (mg)	3.6	21.7	**7.83**	8	2.93	10.2	**5.75**	8	2.98	13.7	**6.76**	8	2.25	10.4	**6.6**	8	**6.68**	YES
Zinc (mg)	7.83	16.1	**11.2**	12	5.7	18.3	**10.8**	12	5.96	17.7	**10.7**	12	5.9	18.1	**10.1**	12	**10.5**	YES
Beta Carotene (RE)	104	599	**284**	*	65	2011	**774**	*	101	2129	**678**	*	41	2730	**818**	*	**704**	*

TABLE 14 Selected Dietary Components from 3-Day Dietary Intake

Population quartiled by age and compared to the 1989 RDA

The selected components from the dietary intakes were quartiled by age. Correlations were done among selected dietary components and selected anthropometric measurements, body composition, nutrition knowledge (KQ), attitudes (AQ), physical activity (PA), and body image statements (BIQ) at the .05 confidence level. In regards to the questionnaire, positive responses toward nutrition were used as the correct responses to be correlated.

Energy intake was correlated ($p<.05$) with data from Bouchard's three day activity record (MIN), Harris Benedict calculation (HB), physical activity statements (PAQ41-49), Kcal statements (1,2,14,17,18,33-40,46) from knowledge and attitude questionnaire, percent body fat (BIA), weight and BMI (Table 15). In the age group of 60-64 years there were no significant relationships. In 65-68 years group there were several significant relationships. Energy intake was significant ($p<.05$) with: physical activity statements 42, 44 and 47; attitude statements 17 and 18; and body image statement 35. In age group 69-74 energy intake was significant ($p<.05$) with percent body fat (BIA); and in age group 75-86 energy intake was significant with body image question 40.

	POPULATION QUARTILED BY AGE (years)			
	60-64	65-68	69-74	75-86
% BF			0.59	
PA42. Exercise gives me energy and helps me get in touch with my body.		0.59		
PA44. I should try to get my heart rate above 19 beats per ten seconds during aerobic ex.		0.55		
PA47. Exercise will improve my coordination and balance		0.61		
AQ17. One reason I have lived as long as I have is because I have a healthy diet.		0.62		
AQ18. It is important for me to get a wide variety of foods in my diet.		0.56		
BIQ35. As an adult, I have tried to gain weight.		0.65		
BIQ40. I rate my figure attractive or somewhat attractive.				0.68

TABLE 15 Significant Correlations Between Energy Intake and Attitude, Knowledge and Body Image
Values represent significance at .05 confidence level.

Total fat intake was correlated with fat/cholesterol statements (2,8,9,20,21,23,25,31,49) from the knowledge and attitude questionnaire, percent body fat (BIA), weight, and BMI. The only significant relationship was in the 69-74 age group. Total fat intake and percent body fat was .64 significant at .05 confidence level. Data indicated that as total fat intake increased so did percent body fat.

Protein intake was correlated with knowledge statements (KQ1-15), attitude statements (AQ16-32), percent body fat (BIA), weight, and BMI (Table 16). In age group 60-64 there was an inverse relationship between protein intake and attitude statement 32 that was -.65 significant ($p<.05$). In the 65-68 age group protein intake was significant with: knowledge statements 2, 6, 7, 8, 9, 11, 12 and 13; attitude statements 16 and 22. Results

indicated that as protein intake increased so did nutrition knowledge in the 65-68 age group. In the 69-74 age group there was a .55 significant correlation ($p<.05$) between protein intake and knowledge statement 14. The age group 75-86 had several significant relationships ($p<.05$) which included: percent body fat; BMI; weight; and attitude statement 21. These findings suggested that as protein intake increased weight and percent body fat increased. Also, health risk of death from cancer, cardiovascular disease and diabetes mellitus increased, thus, the sample population was at risk. The significant inverse relationships ($p<.05$) included: knowledge statements 1, 3 and 14. Results indicated that as protein intake increased knowledge of vitamins and minerals not providing calories and a source of vitamin C is needed in the diet every day decreased in the 75-86 year group.

	POPULATION QUARTILED BY AGE (years)			
	60-64	65-68	69-74	75-86
% BF				0.5
BMI				0.53
Weight				0.6
KQ1. Vitamins and minerals provide no calories.				-0.56
KQ2. Using the food labels I can find out the percent of calories that come from fat.		0.7		
KQ3. A source of vitamin C is required in the diet every day.				-0.89
KQ6. Postmenopausal women need more calcium than men.		0.56		
KQ7. Skim milk contains the same amounts of vitamins, minerals, and protein as whole milk.		0.54		
KQ8. Corn oil is a good source of polyunsaturated fat.		0.43		
KQ9. Saturated fat, associated with coronary heart disease, is found in red meats, butter, and whole milk.		0.65		
KQ11. Calcium is needed for your bones throughout life.		0.58		
KQ12. Whole grain breads are good sources of bran(or fiber) which helps prevent constipation.		0.62		
KQ13. I need to take supplements to get all the nutrients I need.		0.67		
KQ14. A calorie is a measure of the amount of energy provided by a food.			0.55	-0.6
AQ16. The foods I eat affect the way I feel.		0.61		
AQ21. If I found out that a food I really like was not good for me. I would continue to eat it anyway.				0.57
AQ22. At a social gathering, if someone brought a food that I had never tried, I would taste it.		0.7		
AQ32. I drink more than two cups of coffee each day.	-0.65			

TABLE 16 Significant Correlations Between Protein Intake and Attitude and Knowledge Statements

Values represent significance at .05 confidence level.

Calcium, vitamin C, vitamin E, zinc and beta carotene intakes were correlated with statements related to antioxidants (3-7,10,11,13,15,19, 22,24,28-30) from the knowledge and attitude questionnaire.

Calcium intake was not significantly correlated to any statements in the 60-64 age group (Table 17). In 65-68 age group significant relationships ($p<.05$) were: knowledge statements 2, 6, 7, 9 and 11; attitude statements 22, 24 and 30. In the 69-74 age group calcium was significant ($p<.05$) with KQ4 and KQ6. Calcium intake also had a significant inverse relationship of -.50 ($p<.05$) with AQ29. The age group of 75-86 exhibited significant relationships ($p<.05$) with BMI; weight; and AQ24. The significant inverse correlations ($p<.05$) were with KQ1 and KQ3. Once again the findings in this age group show that as calcium intake increased knowledge that vitamins and minerals not providing calories and a source of vitamin C is needed every day decreased.

	POPULATION QUARTILED BY AGE (years)			
	60-64	65-68	69-74	75-86
BMI				0.6
Weight				0.67
KQ1. Vitamins and minerals provide no calories.				-0.61
KQ2. Using the food labels I can find out the percent of calories that come from fat.		0.79		
KQ3. A source of vitamin C is required in the diet every day.				-0.68
KQ4. Antioxidants, vitamins A and C and beta carotene have no effect on the risk of developing cancer.			0.54	
KQ6. Postmenopausal women need more calcium than men.		0.57	0.5	
KQ7. Skim milk contains the same amounts of vitamins, minerals, and protein as whole milk.		0.67		
KQ9. Saturated fat, associated with coronary heart disease, is found in red meats, butter, and whole milk.		0.56		
KQ11. Calcium is needed for your bones throughout life.		0.6		
AQ22. At a social gathering, if someone brought a food that I had never tried, I would taste it.		0.84		
AQ24. Buying nutritious foods requires too much of my monthly income.		0.56		0.6
AQ29. I am more likely to snack on fresh fruits than sweets.			-0.5	
AQ30. If I take vitamins I don't have to worry about what I eat.		0.61		

TABLE 17 Significant Correlations of Calcium Intake and Attitude and Knowledge Statements
Values represent significance at .05 confidence level.

Vitamin C intake in the age group of 60-64 was inversely significant ($p<.05$) with KQ3, which indicated that as vitamin C intake increased knowledge of a source of vitamin C is needed in the diet every day decreased. In age group 65-68 the significant correlations ($p<.05$) were: KQ12, 13 and AQ30. There were no significant relationships between vitamin C intake and knowledge and attitude statements in the age group of 69-74. In the age group of 75-86 the significant correlations ($p<.05$) were: AQ29 and AQ30 (Table 18).

	POPULATION QUARTILED BY AGE (years)			
	60-64	65-68	69-74	75-86
KQ3. A source of vitamin C is required in the diet every day.	-0.58			
KQ12. Whole grain breads are good sources of bran(or fiber) which helps prevent constipation.		0.53		
KQ13. I need to take supplements to get all the nutrients I need.		0.55		
AQ29. I am more likely to snack on fresh fruits than sweets.				0.65
AQ30. If I take vitamins I don't have to worry about what I eat.		0.66		0.66

TABLE 18 Significant Correlations of Vitamin C Intake with Knowledge and Attitude Statements
Values represent significance at .05 confidence level.

Vitamin E intake did not have any significant correlations in the 60-64 and 69-74 age groups (Table 19). In the 65-68 vitamin E was significant ($p<.05$) with: KQ12, 15, AQ22, and 33. In the 75-86 age group vitamin E was inversely significant ($p<.05$) with KQ2 and KQ3. Once again in the 75-86 age group as vitamin E intake increased the knowledge of having a source of vitamin C in the diet every day decreased.

	POPULATION QUARTILED BY AGE (years)			
	60-64	65-68	69-74	75-86
KQ2. Using the food labels I can find out the percent of calories that come from fat.				-0.65
KQ3. A source of vitamin C is required in the diet every day.				-0.65
KQ12. Whole grain breads are good sources of bran(or fiber) which helps prevent constipation.		0.52		
KQ15. I should eat a combination of five fruits and vegetables every day.		0.64		
AQ22. At a social gathering, if someone brought a food that I had never tried, I would taste it.		0.55		
AQ30. If I take vitamins I don't have to worry about what I eat.		0.57		

TABLE 19 Significant Correlations of Vitamin E Intake with Knowledge and Attitude Statements
Values represent significance at .05 confidence level.

Dietary zinc (Table 20) had significant relationships ($p<.05$) in the 60-64 age group with KQ2 and KQ4. In the 65-68 age group there were significant correlations ($p<.05$) with KQ2, 5, 11 and AQ24. In the 69-74 age group the significant relationships ($p<.05$) included: percent body fat (BIA); KQ6 and KQ15. The 75-86 age group exhibited inverse significant correlations ($p<.05$) which were with KQ10 and KQ15.

Beta carotene intake (Table 21) was significantly correlated ($p<.05$) in the 60-64 age group with KQ8 and KQ10. In the 65-68 age group KQ15 and AQ19 was significant ($p<.05$) with beta carotene intake. The 69-74 age group did not have any significant correlations. In the 75-86 age group KQ1 and KQ14 was significant ($p<.05$). AQ28 was inversely significant.

	POPULATION QUARTILED BY AGE			
	60-64	65-68	69-74	75-86
% BF			0.7	
KQ2. Using the food labels I can find out the percent of calories that come from fat.	0.61	0.52		
KQ4. Antioxidants, vitamins A and C and beta carotene have no effect on the risk of developing cancer.	0.64			
KQ5. Vitamin E can help to slow down the aging process.		0.58		
KQ6. Postmenopausal women need more calcium than men.			0.57	
KQ10. The best dietary source of vitamin D is fortified milk.				-0.67
KQ11. Calcium is needed for your bones throughout life.		0.52		
KQ15. I should eat a combination of five fruits and vegetables every day.			0.58	-0.65
AQ24. Buying nutritious foods requires too much of my monthly income.		0.58		

TABLE 20 Significant Correlations with Zinc Intake and Knowledge and Attitude Statements
Values represent significance at .05 confidence level.

	POPULATION QUARTILED BY AGE (years)			
	60-64	65-68	69-74	75-86
KQ1. Vitamins and minerals provide no calories.				0.6
KQ8. Corn oil is a good source of polyunsaturated fat.	0.58			
KQ10. The best source of vitamin D is fortified milk.	0.59			
KQ14. A calorie is a measure of the amount of energy provided by a food.				0.63
KQ15. I should eat a combination of five fruits and vegetables every day.		0.75		
AQ19. It is important for me to get a wide variety of foods in my diet.		0.51		
AQ28. I drink milk almost every day.				-0.75

TABLE 21 Significant Correlations of Beta Carotene Intake with Knowledge and Attitude Statements
Values represent significance at .05 confidence level.

NUTRITION KNOWLEDGE, ATTITUDES, BODY IMAGE and PHYSICAL ACTIVITY

The knowledge (1-15) and attitude (16-32) statements and statements pertaining to fat and cholesterol intake (2,8,9,20,21,23,25,31,49) were correlated with percent body fat (BIA), BMI, weight and body image statements.

The knowledge statements (Table 22) only showed significant correlations ($p<.05$) with the body image statements. In general results indicated that as knowledge increased, body image decreased.

	CORRELATION VARIABLES						
	BIQ33	BIQ34	BIQ35	BIQ36	BIQ37	BIQ38	BIQ40
KQ1. Vitamins and minerals provide no calories.					0.31		
KQ4. Antioxidants, vitamins A and C and beta carotene have no effect on the risk of developing cancer.						-.29	
KQ7. Skim milk contains the same amounts of vitamins, minerals, and protein as whole milk.		-0.34					
KQ11. Calcium is needed for your bones throughout life.		-0.29	0.29				
KQ12. Whole grain breads are good sources of bran(or fiber) which helps prevent constipation.			-0.41	0.32		-0.48	-0.46 -0.41
KQ13. I need to take supplements to get all the nutrients I need.				0.35		-0.33	
KQ15. I should eat a combination of five fruits and vegetables every day.	-0.34	-0.42			-0.38	-0.33	-0.35

TABLE 22 Knowledge Statements' Significant Relationships with Body Image Statements
Values represent significance at .05 confidence level.

The majority of the statistically significant correlations ($p<.05$) of the attitude statements (Table 23) were inverse correlations with the body image statements. Data indicated that as positive attitudes toward nutrition increased, body image decreased.

	CORRELATION VARIABLES							
	AQ16	AQ17	AQ18	AQ19	AQ25	AQ26	AQ27	AQ32
%BF								-0.3
BIQ33. I eat less than I want to keep my weight down.		-0.46						
BIQ.34 I feel guilty after overeating.	-0.36		-0.43	-0.29			-0.34	
BIQ35. As an adult, I have tried to gain weight.						0.35		
BIQ37. I am satisfied with my current weight.	-0.35	-0.33	-0.29					
BIQ40. I rate my figure attractive or somewhat attractive.	-0.41				0.3			

TABLE 23 Attitude Statements' Significant Relationships with Body Image Statemen
Values represent significance at .05 confidence level.

The fat and cholesterol statements (Table 24) that were significantly correlated ($p<.05$) were: KQ8 with BIQ33 and AQ25 with BIQ40. The only inverse significant relationship ($p<.05$) was among AQ25 and BIQ33.

	CORRELATION VARIABLES	
	BIQ33	BIQ40
KQ8. Corn oil is a good source of polyunsaturated fat.	0.35	
AQ25. I often feel too tired to bother fixing a meal.	-0.29	0.3

TABLE 24 Fat/Cholesterol Statements' Significant Relationships with Body Image Statements
Values represent significance at .05 confidence level.

The statements pertaining to kilocalories (1,2,14,17,18,33-40,46) were correlated with data from percent body fat (BIA), BMI, weight, body image statements, Harris Benedict calculation and Bouchard's three day activity record (Table 25). Inverse significant correlations ($p<.05$) with percent body fat, BMI, weight, Harris Benedict calculation, and Bouchard's energy expenditure estimation were exhibited. Results indicated that as

	CORRELATION VARIABLES								
	%BF	BMI	Weight	HB	MIN	BIQ33	BIQ34	BIQ36	BIQ37
KQ1. Vitamins and minerals provide no calories.								0.31	
AQ17. One reason I have lived as long as I have is because I have a healthy diet.						-0.46			-0.33
AQ18. It is important for me to get a wide variety of foods in my diet.							-0.43		-0.29
BIQ33. I eat less than I want to keep my weight down.					-0.31				
BIQ34. I feel guilty after overeating.	-0.38	-0.44	-0.46	-0.43	-0.43				
BIQ35. As an adult, I have tried to gain weight.		0.3	0.37	0.4					
BIQ37. I am satisfied with my current weight.	-0.34	-0.55	-0.5	-0.42					
BIQ38. I consider myself overweight.	-0.48	-0.6	-0.6	-0.58	-0.42				
BIQ39. My spouse/significant other thinks I am overweight.	-0.55	-0.67	-0.66	-0.64	-0.43				
BIQ40. I rate my figure attractive or somewhat attractive.		-0.46	-0.37	1					

TABLE 25 Kcal Statements's Significant Relationships with Body Image
Values represent significance at .05 confidence level.

	CORRELATION VARIABLES		
	% BF	BMI	Weight
BIQ34. I feel guilty after overeating.	-0.38	-0.44	-0.46
BIQ35. As an adult, I have tried to gain weight.		0.3	0.37
BIQ37. I am satisfied with my current weight.	-0.34	-0.55	-0.5
BIQ38. I consider myself overweight.	-0.48	-0.6	-0.6
BIQ39. My spouse/significant other thinks I am overweight.	-0.55	-0.67	-0.66
BIQ40. I rate my figure attractive or somewhat attractive.		-0.46	-0.37

TABLE 26 Body Image Statements' Significant Relationships with Anthropometric Variables
Values represent significance at .05 confidence level.

statements pertaining to kilocalories(BIQ33-35, 37-40) increased with a decrease in percent body fat, BMI, weight, HB energy expenditure estimation and Bouchard's energy expenditure.

The body image statements (33-40) were correlated with percent body fat (BIA), BMI and weight (Table 26). Body Image was inversely significant ($p<.05$) with percent body fat, BMI and weight. Results indicated that body image increased while percent body fat, weight, and health risk decreased.

The percent who answered the body image statements positive toward nutrition are exhibited in Table 27. The data was broken down into two groups: normal weight and over weight. This was done to see if there are any differences among these groups when answering the body image statements. Both groups answered thirteen percent (3 out of 8) of the body image statements positively toward nutrition. Findings indicated that both normal and overweight groups had a poor body image.

	% ANSWERING POSITIVELY	
	Not Overweight (n=24)	Overweight (n=23)
BIQ33. I eat less than I want to keep my weight down.	62.5	39.1
BIQ34. I feel guilty after overeating.	45.8	13
BIQ35. As an adult, I have tried to gain weight.	79.2	85.4
BIQ36. I believe that extra weight at older ages is good.	75.1	73.9
BIQ37. I am satisfied with my current weight.	54.2	86.9
BIQ38. I consider myself overweight.	54.2	4.3
BIQ39. My spouse/significant other thinks I am overweight.	75	17.4
BIQ40. I rate my figure attractive or somewhat attractive.	16.6	60.8

TABLE 27 Body Image
Comparison between normal weight and overweight who answered positively toward nutrition

The physical activity statements (PA41-49) were correlated with Bouchard's activity levels four to eight, Harris Benedict calculation, women's perceived activity, percent body fat, BMI, weight, and body image statements (Table 28). Women who perceived theirself as active had a significant relationship ($p<.05$) with getting their heart rate above 19 beats per ten seconds during aerobic exercise.

	CORRELATION VARIABLES				
	5 BCH	P Act	BMI	BIQ34	BIQ37
PA42. Exercise gives me energy and helps me get in touch with my body.	0.32				
PA43. To receive any real benefit from aerobic exercise, the exercise must be performed continuously for at least 20 min.				-0.3	
PA44. I should try to get my heart rate above 19 beats per ten seconds during aerobic exercise.		0.32	0.3		
PA49. The only way to lose mostly body fat in a weight reduction program is to exercise.					0.31

TABLE 28 Significant Relationships of Physical Activity Statements' with Body Image
Values represent significance at .05 confidence level.

The percent who answered the physical activity statements positively toward physical activity are found in Table 29. The data was broken down into two groups: normal weight and over weight, in order to, identify differences between the two groups. The normal weight group answered seventy-eight percent (7out of 9) of the physical activity statements positively toward physical activity, and the over weight group scored one-hundred

percent on answering the statements positively toward physical activity. Results indicated that the overweight group had a positive knowledge of physical activity but does not incorporate that knowledge into every day life. Interestingly, the two questions the normal weight group missed dealt with losing and maintaining weight.

	% ANSWERING POSITIVELY	
	Not Overweight (n=24)	Overweight (n=23)
PA41. Exercise makes me feel good about me.	100	100
PA42. Exercise gives me energy and helps me get in touch with my body.	100	91.3
PA43. To receive any real benefit from aerobic exercise, the exercise must be performed continuously for at least 20 min.	88	91.3
PA44. I should try to get my heart rate above 19 beats per ten seconds during aerobic exercise.	40	73.9
PA45. Lifting weights will increase my strength and endurance.	80	82.6
PA46. Regular exercise will increase my metabolism.	92	87
PA47. Exercise will improve my coordination and balance.	100	100
PA48. An exercise program should be performed 2-3 times a week in order to benefit from it.	96	95.7
PA49. The only way to lose mostly body fat in a weight reduction program is to exercise.	60	78.2

TABLE 29 Physical Activity

Comparison between normal weight and overweight who answered positively toward physical activity

Table 30 (Appendix I) shows an overall summary of the percentages of the positive responses toward nutrition for the entire questionnaire. A score of seventy percent on the questionnaire indicated adequate level of nutrition knowledge and positive attitudes toward nutrition, a positive body image and an adequate level of physical activity knowledge. Overall, the sample scored 55% on the questionnaire. The sample answered sixty percent (9 out of 15) of the nutrition knowledge questions correctly. The sample answered fifty-nine percent (10 out of 17) of the attitude questions positively. The sample answered thirteen percent (1 out of 8) of the body image questions positively. The study population answered seventy-eight percent (7 out of 9) of the physical activity questions correctly. The findings indicated inadequate levels of nutrition knowledge, negative attitudes toward nutrition, negative body images and an adequate level of knowledge about physical activity.

The knowledge question 50 was pertaining to most commonly used sources of nutrition. Newspaper/ magazines came in first with thirty-eight responses (79%). Television followed with thirty-four responses (71%) and food labels rounded out the top three with thirty-one responses (65%).

CHAPTER 5

DISCUSSION

This chapter presents an interpretation of the findings. Implications of the research are identified and recommendations for future research are given.

Body composition measurements were taken and responses were given to questions related to personal and demographic information, to nutrition knowledge, attitudes, body image, physical activity and three day dietary and three day activity records by forty-eight women aged sixty to eighty-six who exercise on a regular basis. The sample was recruited from Victory Fitness Center, the all women location.

Several assumptions were made about the population. It was assumed that an adequate level of nutrition knowledge and physical activity (at least 70% score on questionnaire) would be accompanied by positive attitudes toward nutrition. It was assumed that adequate knowledge of and positive attitudes toward nutrition would coincide with adequate dietary intake (2/3 of RDA). It was assumed that the study population was physically active because belonged to fitness center and exercised on a regular basis (2-3x/week) their weight and percent body fat would be with in the recommended ranges and exhibit a good overall health status and a positive body image.

The sample's reported frequency of exercise classifies the group as very active; however, the other findings say otherwise. The group exhibited high body fat percentages and high weight measurements which suggest that this population is not as active as originally reported. The high body fat percentages may reflect age related changes in body composition, such as, decrease in lean body mass and an increase in percent body fat (Reilly, 1993 et al.). Fat folds and BIA were good predictors of percent body fat for this population, which is supported by Reilly's (1993) and Visser's (1994) studies on body composition assessment for older adults.

Fifty percent of the population was overweight. This is supported by the BMI and measured weight values. The high value for BMI indicates that the sample is at moderate risk of death from cancer, heart disease and diabetes mellitus. These results are similar to other studies done on older women. Chumlea's (1993), Reilly's (1993) and Visser's (1994) sample populations' exhibited high body weight and percent body fat. Similar results may indicate the need to adjust/raise the "norms" for this population. May be results are not really high, but are reflective of age related body changes, therefore, satisfactory for this population.

Nutritional status was adequate based on anthropometric and dietary intake records. Data from anthropometry measurements indicated that the population had adequate fat and muscle protein reserves. However, energy intake when compared to energy expenditure appeared to be insufficient. Findings showed that dietary intake when compared to the RDA met and in some cases exceeded two thirds of the RDA, which classifies the population's diet as adequate. As a group 100% of the RDA was met and

exceeded for all nutrients except for vitamin E and zinc. When the sample was quartiled by age the 65-68 and 75-86 year groups did not meet 100% of RDA for calcium.

When comparing this study population to that of other studies, this samples' dietary intake is more adequate. Past research has shown that typical diets of older adults in the United States are below the recommended levels for energy, calcium and zinc (Mahalko, 1985; Poppe, 1992; Kerstetter, 1993). This supports the fact that energy intake for this sample was low. The sample's intake did meet two thirds of the RDA for calcium and zinc; however, it did not meet 100%. This is relevant since dietary intake of these nutrients are commonly inadequate in older women.

Morley's (1993) research found that older women are more likely to take vitamin and mineral supplements than men are. This was not the case with this sample only five of the forty-eight participants took vitamin and mineral supplements.

The study population exhibited poor knowledge of nutrition and negative attitudes toward nutrition. The group had a negative body image; however, the sample's knowledge of physical activity was adequate. Like, Thomas's (1990) study, the knowledge and attitudes scores were weak predictors of dietary adequacy. This sample was demonstrative of this, because the group's dietary intake was adequate despite knowledge and attitude scores. Furthermore, Thomas (1990) showed that knowledge and

attitudes were positively correlated in older populations. This was also the case with this sample. The difference was that the group exhibited low knowledge and negative attitudes.

The samples low score for nutrition knowledge may be attributed to the group's main sources of nutrition information, news papers, magazines, television and food labels. This data can only indicate that the sample was not well informed or may be misinformed. This is of great importance to dietitians because of the concern that the public has easy access to unreliable sources of nutrition.

The samples negative attitudes toward nutrition not only come from lack of knowledge, but may also reflect age related changes to the body. For example, a reduced sense of smell, taste or touch or changes in digestive ability could affect attitudes toward food (Kerstetter, 1993 et al.).

The negative body image shown by this sample is similar to Stevens' study (1994) in that over weight women were less satisfied with their body size; however, both normal and over weight subjects had negative body images. Stevens (1994) found that attitudes have a direct effect on body image, thus, negatives attitudes would foster a negative body image, which describes this sample perfectly. Also, the sample's negative body image may stem from high percents of body fat and overweight status.

The group had an adequate knowledge level of physical activity. This may be explained by the notion that attitude and behavior are directly related, but knowledge and behavior are not (Thomas, 1990 et al.). With this in mind, just because an individual is knowledgeable about physical activity does not mean the individual will apply that knowledge to their life style.

Findings from this study can be used to develop education programs for older women. Data from the questionnaire can be used to find out what topics need to be discussed or are more relevant or motivating to older women. Furthermore, this data can be used to identify attitudes toward nutrition. Once those are identified techniques can be developed to foster positive attitudes toward nutrition. Those can be used in conjunction with education programs that are specifically tailored to fit the needs of older women. Hopefully, this would motivate the women to incorporate this knowledge of and positive attitudes toward nutrition into their lives.

The results of this study are eye opening in regards to physical activity, body composition, nutrition knowledge and attitudes and body image. I would recommend that more education and research in this population be done. Like Thomas (1990), I believe research needs to examine this populations motivational factors, in regards to the relationships amongst positive attitudes, dietary practices and knowledge. These variables need to be examined to determine if older women are more motivated to develop positive attitudes and dietary practices toward nutrition with increased knowledge of nutrition, or is it the positive attitudes and dietary practices toward nutrition that motivate this group to seek more knowledge of nutrition.

If this study was done again the proceeding recommendations are made. First, a larger and more multi cultured population should to be used to get an more accurate representation of the United States. Secondly, do a longitudinal study where exercise programs and heart rates are monitored to get more accurate information on the differences between active and sedentary older women. Third, a more in-depth examination of sources for

nutrition information. Finally, continue to update the nutrition knowledge, attitude and body image questionnaire so it will reflect the latest nutrition findings.

APPENDIX A

Human Subject Review Board Approval

BIOMEDICAL SCIENCES REVIEW COMMITTEE
RESEARCH INVOLVING HUMAN SUBJECTS
THE OHIO STATE UNIVERSITY

__ Original Review
_x_ Continuing Review
__ Five-Year Review
__ Amendment

ACTION OF THE REVIEW COMMITTEE

With regard to the employment of human subjects in the proposed research:

92H0126 THE RELATIONSHIP BETWEEN NUTRITION KNOWLEDGE, ATTITUDES AND DIETARY INTAKE AMONG OLDER ADULTS, Mary C. Mitchell, Human Nutrition, and Food Management

_x_ APPROVED

__ DISAPPROVED

__ APPROVED WITH STIPULATIONS*

__ WAIVER OF WRITTEN CONSENT GRANTED

*Stipulations stated by the Committee have been met by the investigator and, therefore, the protocol is **APPROVED>**

It is the responsibility of the principal investigator to retain a copy of **each** signed consent form for at least three (3) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subjects Committee for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the Review Committee, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: March 18, 1996

Signed _____
Chairperson

HS-025H (Rev. 2/94)

APPENDIX B

Description of the study/sign up sheet

ATTENTION LADIES: Kristin needs your help. She is working on her Masters at OSU and needs volunteers for her research study. The topic is: **BODY COMPOSITION AND NUTRITION KNOWLEDGE, ATTITUDES AND BODY IMAGE OF WOMEN WHO ARE ≥ 60 YEARS OF AGE WHO EXERCISE**. It will not take up a lot of time. She only needs to see you two times for a **combine total of 1 hour**. For more details talk to Kristin. If you are interested in participating please write your name and phone number below. THANK-YOU!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

NAME	PHONE

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APPENDIX C

Informed consent document

OHIO STATE UNIVERSITY Protocol No.
CONSENT TO INVESTIGATIONAL TREATMENT OR PROCEDURE

I _____, **hereby authorize or direct Dr. Mary C. Mitchell or associates or assistants of her choosing, to perform the following treatment or procedure (describe in general terms):** Measurement of height, weight, fatfolds, arm circumference, knee height, arm length and body composition using Bioelectrical Impedance Analysis (BIA) and collection of information regarding dietary intake, physical activity. Completion of questionnaire regarding knowledge of and attitudes toward physical activity and nutrition and body image.

upon _____
(myself or name of subject)

The experimental (research) portion of the treatment or procedure is: analyze data collected and compare it to standards

This is done as part of an investigation entitled: Body Composition and Attitudes, Knowledge and Practice Related to Nutrition and Physical Activity of Older Adults.

1. **Purpose of the procedure or treatment:** collect information regarding body composition, activity levels, dietary intake and knowledge and attitudes related to body image, physical activity, nutrition and eating of older adults.

2. **Possible appropriate alternative procedures or treatment (not to participate in the study is always an option):** not to participate

3. **Discomforts and risks reasonable to be expected:** none

4. **Possible benefits for subjects/society:** To subjects: increased information regarding nutrition and physical exercise. To society: contribute to the development of standards for nutritional assessment in older adults and planning of education programs .

5. **Anticipated duration of the subject's participation (including number of visits):** Interview of 30-60 minutes and completion of dietary and activity records.

I hereby acknowledge that Dr. Mary C. Mitchell or associate **has provided information about the procedure described above, about my rights as a subject, and she/he answered all questions to my satisfaction. I understand that I may contact her/him at Phone No. 292-8189 or 876-5399 should I have additional questions. She/he has explained the risks described above and I understand them; she/he has also offered to explain all possible risks or complications.**

I understand that, where appropriate, the U.S. Food and Drug Administration may inspect records pertaining to this study. I understand further that records obtained during my participation in this study that may contain my name or other personal identifiers may be made available to the sponsor of this study. Beyond this, I understand that my participation will remain confidential.

I understand that I am free to withdraw my consent and participation in this project at any time after notifying the project director without prejudicing future care. No guarantee has been given to me concerning this treatment or procedure.

I understand that in signing this form that, beyond giving consent, I am not waiving any legal rights that I might otherwise have, and I am not releasing the investigator, the sponsor, the institution, or its agents from any legal liability for damages that they might otherwise have.

In the event of injury resulting from participation in this study, I understand that immediate medical treatment is available at University Hospitals of The Ohio State University and that the costs of such treatment will be at my expense; financial compensation beyond that required by law is not available. Questions about this should be directed to the Human Subjects Review Office at 292-9046.

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date_____Time_____Signed_____
AM/PM (Subject)

Witness(es)_____ _____
If (Person Authorized to
Required_____ Consent for subject,
if Required)

I certify that I have personally completed all blanks in this form and explained them to the subject or his/her representative before requesting the subject or his/her representative to sign it.

Signed_____
(Signature of Project Director or his/her
Authorized Representative)

APPENDIX D

Demographic and Personal Information Quesitonnaire

code_____

DEMOGRAPHIC AND PERSONAL INFORMATION

1. How old are you?_____ How tall are you?_____ What is your current weight?_____Have you had any recent wt. loss?_____

2. What is your marital status ?
single married separated divorced widowed

3. What is your ethnic background? Caucasian African American Hispanic Asian Native American Other:_____

4. Is your place of residence a house, apartment or retirement community?

5. Do you live alone? YES NO

6. Who does your shopping and cooking?
Self Family Roommate
Do you participant in feeding programs(ie. congregate meal program)?
Are you a recipient of donations or food stamps?

7. Do you have <8 9-12 13-16 >16 years of education?

8. What is your employment status? parttime fulltime retired volunteer
what_____ where_____ hrs/wk_____
Do you consider your work active or sedentary?

9. How would you rate your health status? poor fair average good excellent

Do you have any medical problems like,

HBP HCHOL. HEART CONDITION DIABETES OSTEOPOROSIS

ARTHRITIS DURATION_____

Have you been hospitalized in the last three months?_____

10. How many hours of sleep do you get in a 24 hour period? Night_____
Day_____

11. Do you participate in land aerobics ?
1-2 times/week 3-5 times/week
1-3 times/month Never
Kind: LI HI/LO STEP TIME:_____

12. Do you participate in water aerobics?
1-2 times/week 3-5 times/week
1-3 times/month Never
TIME:_____

13. Do you weight train(machines/free weights)?
1-2 times/week 3-5 times/week
1-3 times/month Never
EQUIPMENT USED WTS/REPS

14. Do you ride the stationary bike?
1-2 times/week 3-5 times/week
1-3 times/month Never
For: 5-10 min 10-15 min 15-20 min >20min
SPEED_____ LEVEL_____

15. Do you walk on the treadmill?
1-2 times/week 3-5 times/week
1-3 times/month Never
For: 5-10 min 10-15 min 15-20 min >20 min
SPEED_____ LEVEL_____

16. Do you use the step machine?
1-2 times/week 3-5 times/week
1-3 times/month Never
For: 5-10 min 10-15 min 15-20 min >20 min
LEVEL_____

17. Do you participate in any other exercise activities like walking or golfing? How often/far/long?

18. Is there anything else that you would like to share with me?

APPENDIX E

Data collection sheet

Code_____

DATA SHEET

Height_____ _____ _____

Weight_____ _____ _____

Wrist breadth_____ _____ _____

Elbow breadth_____ _____ _____

Ankle breadth_____ _____ _____

MAMC_____ _____ _____

Waist circum. _____ _____ _____

Hip circum._____ _____ _____

TSF_____ _____ _____

Subscapular_____ _____ _____

Biceps_____ _____ _____

Suprailiac_____ _____ _____

Knee ht._____ _____ _____

BIA _____ _____ _____

BMI_____ _____ _____

APPENDIX F

Nutrition Knowledge, Attitudes and Body Image Questionnaire

code_____

NUTRITION KNOWLEDGE, ATTITUDES AND BODY IMAGE QUESTIONNAIRE

Please completely fill out the questionnaire. Your knowledge and opinions are essential to the study and are greatly appreciated.

This questionnaire is not intended to be a test, but has been designed to help us get a better indication of adults' understanding of nutrition, adults' attitudes toward nutrition, nutritional concerns, body image and physical activity.

Please, read each statement carefully and then respond in one of these four ways:

STRONGLY AGREE (**SA**)
AGREE (**A**)
UNDECIDED (**U**)
DISAGREE (**D**)
STRONGLY DISAGREE (**SD**)

Remember this is not a test. Whenever possible, let your own personal experience determine your answer. Do not spend much time on any item. Circle the letter below each question that corresponds to your answer. If in doubt, circle the letter which seems most nearly to express your present feeling about the statement.

1. Vitamins and minerals provide no calories.
   SA A U D SD

2. Using the food labels I can find out the percent of calories that come from fat.
   SA A U D SD

3. A source of vitamin C is required in the diet every day.
   SA A U D SD

4. Antioxidants, vitamins A and C and beta carotene have no effect on the risk of developing cancer.
   SA A U D SD

5. Vitamin E can help to slow down the aging process.
   SA A U D SD

6. Postmenopausal women need more calcium than men.
   SA A U D SD

7. Skim milk contains the same amounts of vitamins, minerals, and protein as whole milk.
SA A U D SD

8. Corn oil is a good source of polyunsaturated fat.
SA A U D SD

9. Saturated fat, associated with coronary heart disease, is found in red meats, butter, and whole milk.
SA A U D SD

10. The best dietary source of Vitamin D is fortified milk.
SA A U D SD

11. Calcium is needed for your bones throughout life.
SA A U D SD

12. Whole grain breads are good sources of bran(or fiber) which helps prevent constipation.
SA A U D SD

13. I need to take supplements to get all the nutrients I need.
SA A U D SD

14. A calorie is a measure of the amount of energy provided by a food.
SA A U D SD

15. I should eat a combination of five fruits and vegetables every day.
SA A U D SD

16. The foods I eat affect the way I feel.
SA A U D SD

17. One reason I have lived as long as I have is because I have a healthy diet.
SA A U D SD

18. It is important for me to eat regular meals daily.
SA A U D SD

19. It is important for me to get a wide variety of foods in my diet.
SA A U D SD

20. If my doctor told me to reduce cholesterol in my diet, I would try to do so.
SA A U D SD

21. If I found out that a food I really like was not good for me. I would continue to eat it anyway.
SA A U D SD

22. At a social gathering, if someone brought a food that I had never tried, I would taste it.
SA A U D SD

23. I eat less nutritious meals when I eat alone than when I eat with others.
SA A U D SD

24. Buying nutritious foods requires too much of my monthly income.
SA A U D SD

25. I often feel too tired to bother fixing a meal.
SA A U D SD

26. There are many foods that I have given up because they just don't agree with me.
SA A U D SD

27. There are many foods that I have given up because I cannot chew them well.
SA A U D SD

28. I drink milk almost every day.
SA A U D SD

29. I am more likely to snack on fresh fruits than sweets.
SA A U D SD

30. If I take vitamins I don't have to worry about what I eat.
SA A U D SD

31. I almost always add salt to my food.
SA A U D SD

32. I drink more than two (2) cups of coffee each day.
SA A U D SD

33. I eat less than I want to keep my weight down.
SA A U D SD

34. I feel guilty after overeating.
SA A U D SD

35. As an adult, I have tried to gain weight.
SA A U D SD

36. I believe that extra weight at older ages is good.
SA A U D SD

37. I am satisfied with my current weight.
SA A U D SD

38. I consider myself overweight.
SA A U D SD

39. My spouse/significant other thinks I am overweight.
SA A U D SD

40. I rate my figure attractive or somewhat attractive.
SA A U D SD

41. Exercise makes me feel good about me.
SA A U D SD

42. Exercise gives me energy and helps me get in touch with my body.
SA A U D SD

43. To receive any real benefit from aerobic exercise, the exercise must be performed continuously for at least 20 minutes.
SA A U D SD

44. I should try to get my heart rate above 19 beats per ten seconds during aerobic exercise.
SA A U D SD

45. Lifting weights will increase my strength and endurance.
SA A U D SD

46. Regular exercise will increase my metabolism.
SA A U D SD

47. Exercise will improve my coordination and balance.
SA A U D SD

48. An exercise program should be performed 2-3 times a week in order to benefit from it.
SA A U D SD

49. The only way to lose mostly body fat in a weight reduction program is to exercise.
SA A U D SD

50. Where have you learned about nutrition? (Circle all that apply)

Newspaper/magazine	Professional nutrition literature
Radio	Home economist
Television	Registered dietitian
Books, like diet books/cook books	Nutritionist
Food labels	Physician
Studied in school	Nurse
Neighbors	Spouse
Friends	Others, please specify_____
Relatives	

The information you have provided is greatly appreciated and will help to gain a better understanding of the nutritional knowledge, attitudes, body image and physical activity of mature women.

THANK YOU SO MUCH FOR YOUR TIME AND COOPERATION!!!!!

APPENDIX G

Take home packet

Thank you for participating in my thesis project!!!!!!!!!!

Please seal your records in the envelope provided and return no later than the following Friday_____. If you would like to know your results please include a self-addressed stamped envelope with your records. You can drop off your materials at the front desk of Victorys.

If you have any questions please contact me at 866-2902 or Dr. Mitchell at 292-8189.

Thanks Again!!!

Kristin Ward

Three-day dietary record.

On the attached forms, record everything you eat or drink (except water) for three consecutive days (Use 2 weekdays and one weekend day). Begin with the time you wake in the morning and finish with the last thing you eat during that 24 hour period.

Date each sheet and record the time, what you ate and the approximate amount you consumed. It would be very helpful if you would indicate how foods were prepared or Brand names. A sample food Record is enclosed to assist you.

I will review and collect the three-day dietary records and the activity records next week. If you are taking a nutrient supplement, please enclose the brand name, label or package with your materials so that I may record the content. If you have any questions, please call me at 866-2902 or Dr. Mitchell at 292-8189.

Thank you.

Kristin Ward

Sample 24 Hour Food Record

Name: _____ Date: _____ Phone: _____

Date	Kind of Food	How Prepared/Brand Name	Amount/Size of Serving
9/2/95	Coffee	Folgers	1 cup
7:30 am	Cheerios	General Mills	1 cup
	2% Milk	Kroger	12 ounces
	Toast	Wheat	1 slice
12:00			
	Turkey Sandwich		
	Bread	Orowheat, Wheatberry	2 slices
	Turkey Breast	Hormel	3 slices
	Diet Mayonnaise	Kraft	1 tbsp.
	Lettuce		1 leaf
	Tomato		2 slices
	Crackers	Wheat thins	6 crackers
	Apple juice		1 box (oz.)
3:45 pm	Tab		12 ounces
	Cornchips	Fritolay	1 pkg. (1 1/2 oz.)
6:30 pm	Spaghetti	Homemade	1 cup (cooked)
	Tomato meat sauce	Ground chuck, tomato sauce (Hunt's)	3/4 cup
	String beans	DelMonte	1/3 cup
	Lettuce	Iceberg	1 cup
	Tomato		1/2 small
	French dressing	Kraft diet	2 tbsp.
	2% milk	Kroger	1 cup
8:30 pm	Ice cream	Bryers Strawberry	1/2 cup

24 Hour Food Record

Please complete this form for 3 days (2 weekdays and 1 weekend day).

Date_____ Day of Week_____ Name _____

Phone _____

Time	Kind of Food	How Prepared/Brand Name	Amount/Size Serving	Code

ACTIVITIES LIST

On the attached activity record, use these activity level numbers (values) to record what you do for 3 typical days (2 weekdays and one weekend day).

Categorical Value	Examples of Activities
1	Sleeping; resting in bed
2	Sitting: eating, listening, writing, watching television Light activity standing: washing, cooking, brushing, combing
4	Slow walk (<2.5 miles/hour), driving, to dress, to shower, etc.
5	Light manual work: floor sweeping, window washing, painting, waiting on tables, nurse's aide chores, several house chores, walking at 2.5 to 3.7 miles/hour
6	Leisure activities and sports in a recreational environment: baseball, golf, volleball, canoeing or rowing, archery, bowling, cycling (<6.2 miles/hour), table tennis, recreational ball games at school
7	Manual work at moderate pace: loading and unloading
8	Leisure and sport activities of higher intensity (not competitive): canoeing (3.1 to 5.0 miles/hour), bicycling (> 9.3 miles/hour), dancing, skiing, badminton, swimming, tennis, horseback riding, walking (>3.7 miles/hour), fitness exercises, calisthenics, water skiing, gymnastics
9	Intense manual work, high intensity sport activities or sport competition: carrying heavy loads, jogging or running (>5.5 miles hour), racquetball, badminton, swimming, tennis, cross country skiing (> 5.0 miles/hour), hiking and mountain climbing, orienteering, soccer, European handball, water-polo

2 WEEKDAYS
1 WEEK-END DAY

ACTIVITY RECORD

Name:

Subject Number:

Date:

Day:

DIRECTIONS:

Write in the space provided the categorical value which corresponds best to the dominant activity of each 15-minute period. Please, consult the activity list to establish the proper coding. In case of doubt, make a note on the form and ask dietitian.

Notes:

List Today's Activities:

Hour \ Minutes	0 - 15	16 - 30	31 - 45	46 - 60
Time Began: Midnight 12 am				
1 am				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
Noon 12 pm				
1 pm				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				

APPENDIX H

Data coding

code_____

(1) (2) (3) (4) Physical Activity

NUTRITION KNOWLEDGE, ATTITUDES AND BODY IMAGE QUESTIONNAIRE

Please completely fill out the questionnaire. Your knowledge and opinions are essential to the study and are greatly appreciated.

This questionnaire is not intended to be a test, but has been designed to help us get a better indication of adults' understanding of nutrition, adults' attitudes toward nutrition, nutritional concerns, body image and physical activity.

Please, read each statement carefully and then respond in one of these four ways:

STRONGLY AGREE (**SA**)
AGREE (**A**)
UNDECIDED (**U**)
DISAGREE (**D**)
STRONGLY DISAGREE (**SD**)

Remember this is not a test. Whenever possible, let your own personal experience determine your answer. Do not spend much time on any item. Circle the letter below each question that corresponds to your answer. If in doubt, circle the letter which seems most nearly to express your present feeling about the statement.

1. Vitamins and minerals provide no calories.
   SA A U D SD
   5 4 3 2 1
2. Using the food labels I can find out the percent of calories that come from fat.
   SA A U D SD
   —
3. A source of vitamin C is required in the diet every day.
   SA A U D SD
   —
4. Antioxidants, vitamins A and C and beta carotene have no effect on the risk of developing cancer.
   SA A U D SD
   1 2 3 4 5
5. Vitamin E can help to slow down the aging process.
   SA A U D SD
   —
6. Postmenopausal women need more calcium than men.
   SA A U D SD
   —

APPENDIX I

Table 30 Nutrition Knowledge, Attitudes and Body Image Questionnaire with % of Positive Answers

Knowledge Questions:	SA	A	U	D	SD	%C
1. Vitamins and minerals provide no calories.	17	18	6	4	3	72.9
2. Using the food labels I can find out the percent of calories that come from fat.	16	24	8	0	0	83.3
3. A source of vitamin C is required in the diet every day.	20	26	1	1	0	95.7
4. Antioxidants, vitamins A and C and beta carotene have no effect on the risk of developing cancer.	1	5	12	21	9	62.7
5. Vitamin E can help to slow down the aging process.	5	11	25	6	1	14.6
6. Postmenopausal women need more calcium than men.	25	21	1	0	1	95.9
7. Skim milk contains the same amounts of vitamins, minerals and protein as whole milk.	27	17	4	0	0	91.7
8. Corn oil is a good source of polyunsaturated fat.	10	20	13	5	0	62.5
9. Saturated fat, associated with coronary heart disease, is found in red meats, butter, and whole milk.	31	13	3	1	0	91.7
10. The best dietary source of Vitamin D is fortified milk.	8	19	12	9	0	56.3
11. Calcium is needed for your bones throughout life.	30	17	1	0	0	97.9
12. Whole grain breads are good sources bran(or fiber) which helps prevent constipation.	22	23	2	1	0	93.7
13. I need to take supplements to get all the nutrients I need.	8	16	5	15	4	39.6
14. A calorie is a measure of the amount of energy provided by a food.	14	19	10	5	0	68.8
15. I should eat a combination of five fruits and vegetables every day.	28	19	1	0	0	97.9

50. Where have you learned about nutrition?

Newspaper/magazine 38	Television 34
Food labels 31	Books, like diet books/cook books 26
Relatives 17	Studied in school 17
Physician 21	Friends 21
Professional nutrition literature 16	Radio 15
Registered dietitian 12	Nutritionist 8
Nurse 6	Neighbors 5
Home economist 4	Spouse 3
Others, please specify Jenny Craig 1	

Attitude Questions:	SA	A	U	D	SD	%C
16. The foods I eat affect the way I feel.	28	18	1	1	0	95.8
17. One reason I have lived as long as I have is because I have a healthy diet.	13	22	7	5	1	72.9
18. It is important for me to eat regular meals daily.	20	23	3	2	0	89.6
19. It is important for me to get a wide variety of foods in my diet.	28	19	1	0	0	97.9
20. If my doctor told me to reduce cholesterol in my diet, I would try to do so.	22	24	1	1	0	95.8
21. If I found out that a food I really like was not good for me. I would continue to eat it anyway.	2	8	9	8	21	60.5
22. At a social gathering, if someone brought a food that I had never tried, I would taste it.	14	24	6	4	0	79.2
23. I eat less nutritious meals when I eat alone than when I eat with others.	2	14	3	7	22	60.2
24. Buying nutritious foods requires too much of my monthly income.	0	0	6	25	17	87.5
25. I often feel too tired to bother fixing a meal.	3	8	4	21	12	68.8

TABLE 30 (continued)

Table 30 (continued)

26. There are many foods that I have given up because they just don't agree with me.	**4**	11	4	18	11	60.4
27. There are many foods that I have well.	1	3	1	25	**18**	89.6
28. I drink milk almost every day.	**14**	**19**	4	6	5	68.8
29. I am more likely to snack on fresh fruits than sweets.	7	18	4	16	3	52.1
30. If I take vitamins I don't have to worry about what I eat.	0	0	3	25	20	93.8
31. I almost always add salt to my food.	0	10	2	18	18	75
32. I drink more than 2 cups of coffee each day.	6	12	1	18	11	60.4
Body Image Questions:	SA	A	U	D	SD	%C
33. I eat lee than I want to keep my weight down.	2	14	8	19	5	50
34. I feel guilty after overeating.	10	22	2	14	0	33.4
35. As an adult, I have tried to gain weight.	1	**4**	2	11	**30**	85.4
36. I believe that extra with at older ages is good.	1	7	4	20	16	16.7
37. I am satisfied with my current weight.	1	**9**	4	22	12	20.9
38. I consider myself overweight.	13	15	6	10	**4**	29.1
39. My spouse/significant other thinks I am overweight.	7	8	10	13	**10**	48.9
40. I rate my figure attractive or somewhat attractive.	2	22	6	13	5	50
Activity Questions:						
41. Exercise makes me feel good about me.	**29**	**19**	0	0	0	100
42. Exercise gives me energy and helps me get in touch with my body.	**26**	**20**	2	0	0	95.9
43. To receive any real benefit from aerobic exercise, the exercise must be performed continuously for at least 20 minutes.	**19**	**24**	3	2	0	89.6
44. I should try to get my heart rate above 19 beats per ten seconds during aerobic exercise.	12	15	19	2	0	56.3
45. Lifting weights will increase my strength and endurance.	13	**26**	9	0	0	81.3
46. Regular exercise will increase my metabolism.	20	**23**	5	0	0	89.6
47. Exercise will improve my coordination and balance.	21	**27**	0	0	0	100
48. An exercise program should be performed 2-3 times a week in order to benefit from it.	19	**27**	2	0	0	95.9
49. The only way to lose mostly body fat in a weight reduction program is to exercise.	8	25	6	8	1	68.8

TABLE 30 Nutrition Knowledge, Attitudes and Body Image Questionnaire
SA=Strongly Agree A=Agree U=Undecided D=Disagree SD=Strongly Disagree
%C=Percent Answering Question Positive Toward Nutrition (N=48)
Numbers in bold are correct answers for that question

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