ASSESSING NUTRITION KNOWLEDGE
AND NUTRITIONAL RISK LEVEL OF OLDER WOMEN
IN EXTENSION HOMEMAKERS ASSOCIATION

A THESIS SUBMITTED
TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
MASTER OF SCIENCE IN DIETETICS IN THE DEPARTMENT OF
FAMILY AND CONSUMER SCIENCES

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BALL STATE UNIVERSITY
MUNCIE, INDIANA
DECEMBER 2012
ABSTRACT

THESIS: Assessing Nutrition Knowledge and Nutritional Risk Level of Older Women in Extension Homemakers Association

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DEGREE: Master of Science

COLLEGE: Applied Sciences and Technology

DATE: December 2012

PAGES: 94

The purpose of this study was to examine the extent of nutrition knowledge of older women and compare their nutrition knowledge score with regards to nutritional risk level, age, and level of education attained. This study examined relationships between nutritional risk level and age subgroups of participants in regards to nutrition knowledge scores. Members of the Indiana Extension Homemakers Association (IEHA) of Shelby County (n=92) were given the DETERMINE Checklist with demographic survey and a nutrition knowledge questionnaire. Results: nutrition knowledge scores were inversely associated with nutritional risk level and significantly different between levels of education attained; there was significant correlation between nutritional risk level and level of education. No significant interactions with nutrition knowledge scores and all variables combined (nutritional risk level, age, and level of education attained) were noted. This study contributes to the limit amount of research done with Extension Homemakers and will help identify future program needs and nutrition education topics.
ACKNOWLEDGEMENTS

This thesis would not have been possible without the support, encouragement, and guidance of my committee, family, friends, and all of my professors and instructors at Ball State University who helped guide me through graduate school. I want to give a special thanks to my parents for all of their support and encouragement, for which I would not be where I am today without them. I want to thank my thesis professor, Dr. Alice Spangler, for all of her advice, guidance, patience, and confidence in me that I would reach my goals. Thanks to my committee members, Mrs. Kimberli Pike and Dr. Denise Seabert, whose knowledge, input, and advice helped make this study successful. Thanks to the panel of experts, Dr. Jo Carol Chezem, Dr. Carol Friesen, and Mrs. Mary Snell, for their invaluable expertise. Thank you to Dr. Kianre Eouanzoui, for his support and countless hours in helping me with my data analysis. The time and dedication given to just one student’s education is priceless - Thank you.

Special thanks to the participants, the Indiana Extension Homemakers Association of Shelby County members; without them this project would not have been possible.
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CHAPTER ONE

INTRODUCTION

Older adults represent a growing proportion of the global population. Adults aged 60 years and older accounted for approximately ten percent of the world’s population in 2000; this rate is projected to increase to 21 percent, representing one in five persons, by 2050 (Department of Economic and Social Affairs [DESA], 2002). Even though life expectancy among older adults has increased drastically from previous generations, there are still many people affected by chronic diseases/conditions like diabetes, hypertension, heart/atherosclerosis complications, sarcopenia, and cognitive function (DESA, 2002; Bandayrel & Wong, 2011; Administration on Aging [AoA], 2009).

Poor nutrition adversely affects overall health status and chronic conditions. An integral component to improving nutritional status is through nutrition education. Nutrition education gives people the knowledge and tools to make healthy decisions when it comes to food choices. Older adults have been acquiring dietary behaviors and nutrition knowledge through a lifetime of experiences. However, older adults are at higher risk of being targeted for fad, fraud, and faulty information (Devine, 2005; Yen, 1981).
Lack of nutrition knowledge, among other factors, has been associated with poor food choices and dietary habits, malnutrition, and increased risk of chronic conditions like diabetes, hypertension, and cardiovascular disease (Higgins & Barkley, 2003). Bobroff et al. (2003) implemented weekly education modules to older adults (aged 55 - 103 years old; n=20) attending congregate nutrition sites. Researchers found at least 61 percent of the participants indicated a plan to make changes in their eating behaviors as a result of the nutrition education. Also, participants indicated a specific behavior change that they planned to make in three of the five lessons (Bobroff et al., 2003). Wellman, Kamp, Kirk-Sanchez, and Johnson (2007) evaluated the Eat Better Move More program over a 12-week period, in which participants (n= 620; 82% women, mean age 74.6 years) attended weekly sessions covering topics/activities about nutrition and physical activity. Results indicated an increase in fruit and vegetable intake along with incorporating more physical activity into daily living, such as using the stairs, increasing daily steps, and amount of blocks walked (Wellman, Kamp, Kirk-Sanchez, & Johnson, 2007). These studies show that the information given at the nutritional education programs for older adults can increase the chance of positive, healthful behavior changes.

Assessing nutrition knowledge and health status can be key indicators for evaluating a nutrition program that is for a targeted audience. This study was aimed to assess nutrition knowledge and nutritional risk level of older women participating in the Indiana Extension Homemakers Association (IEHA). The researcher was interested in older women who are a part of Extension Homemakers Association because of the group’s mission of “making homes better homes” and strengthening families through
continuing education, leadership development, and volunteer community support
(Indiana Extension Homemakers Association [IEHA], 2012).

Being a part of Extension Homemakers provides opportunities to learn, grow, and care; the following supporting statements are from the IEHA:

- **Learn**: meet with people in an educational and social setting, share experiences and information, and keep up-to-date on new knowledge and research.
- **Grow**: experience and develop personal growth and skills, and share leadership responsibilities for programs and projects.
- **Care**: make a difference in today’s world and support projects that help children and families live better lives.

(IEHA, 2012)

The IEHA offers focus group areas that members can participate in. These areas include education, leadership, volunteer community support, and activities. Foods and nutrition is a topic area and this research aims to evaluate nutrition knowledge and compare levels of knowledge with those of varying nutritional risk levels and demographic factors (age and education level). This research may also be useful to a broader spectrum of people since it may help provide the necessary tools and information to other organizations to help evaluate new or existing nutrition programs as well as develop nutrition education materials.
Problem

As people grow older, their overall health potentially deteriorates. This increases the risk of nutritional-related health concerns such as osteoporosis, protein-energy malnutrition, hypertension, heart-related diseases, high cholesterol, and diabetes. Being part of an organization that offers nutrition education can help those older adults not only increase their knowledge about nutrition, but also make healthier decisions. This study was aimed to examine nutrition knowledge in comparison to nutrition risk, age, and level of education.

Purpose

The purpose of this study was to examine the extent of nutrition knowledge of older women involved in the Indiana Extension Homemakers Association (IEHA) and compare this to the IEHA participants’ nutritional risk level, age, and level of education attained. This study also determined relationships between nutrition knowledge and age subgroups of older adults. Also, age subgroups, ethnic background, and nutritional risk levels were explored to determine if there were interactions with regard to differences in nutrition knowledge scores.

Null Hypotheses

In order to test each hypothesis, it is stated in the following null form:

1. There is no difference between the nutrition knowledge score among older women participating in IEHA according to their nutritional risk level.
2. There is no difference between nutrition knowledge score according to the level of education of older women participating in IEHA.

3. There is no relationship between age and nutritional risk level of older women participating in IEHA.
   a. There is no relationship between level of education attained and nutritional risk level of older women participating in IEHA.

4. There is no interaction among nutritional risk, education, and age with regard to nutrition knowledge scores of older women participating in IEHA.

Rationale

Nutritional status and well-being is a recognized, integral component for older adults in terms of health, independences, and overall quality of life (Wellman, 2007). The benefits of nutritional well-being include: the prevention or delayed onset of certain chronic diseases and their complications; better management of existing health problems, improved recovery from illness; and improved physical, social, and mental well-being (American Dietetic Association [ADA], 1987).

This research provided a comprehensive understanding of older adults’ nutrition knowledge with regards to their level of nutritional risk, age, and level of education. Nutrition education can be effective in helping older people modify their dietary behaviors. Therefore it is important to assess nutrition knowledge for not only effectiveness of nutrition education programs, but also because research has shown that a correlation exists between increased nutrition knowledge and increased nutritional well-being (Higgins & Barkley, 2004; Keller, Hedley, Hadley, Wong, & Vanderkooy, 2005).
Assumptions

The researcher made the following assumptions in the implementation of the study and in the interpretation of the data:

1. The participants were unbiased and truthful when completing the survey for this study.
2. The participants were able to read and comprehend the instruments.
3. The level of nutrition knowledge of the older adults can be measured.
4. The DETERMINE Checklist is an accurate and valid reflection of nutrition status.

Definitions

1. Cooperative Extension: established in 1914, was designed as a partnership of the U.S. Department of Agriculture and the land grant universities, which were authorized by the Federal Morrill Acts of 1862 and 1890. It provides educational programs in agriculture and natural resources, home economics, community resource development, and youth development (Rainey & Cason, 2001).
2. Cooperative Extension System: a nationwide network established to extend research-based knowledge and technology from the laboratory to the community (Rainey & Cason, 2001).
3. DETERMINE Your Nutritional Health Checklist: a public awareness tool that can be self-administered or conducted by anyone who interacts with older family
members, friends, or clients; the mnemonic DETERMINE highlights warning signs of poor nutritional status (*Nutrition Screening Initiative*, 1992).

4. Malnutrition: a state in which a deficiency, excess, or imbalance of energy, protein, and other nutrients causes adverse effects on body form, function, and clinical outcome (Stratton, 2003).

5. Older Adult: 65 years of age and older (ADA, 2000).

6. Older Adult & Subgroups: Young-Old: 65 to 74 years of age; Old: 75 to 85 years of age; Oldest-Old: 85 years of age and older (ADA, 2000).

7. Education: level of formal education; number of completed years: ≤ 8, 9-11, 12, 13+. 
CHAPTER TWO

REVIEW OF LITERATURE

The purpose of this study was to determine nutrition knowledge in comparison with nutritional risk level, age, and level of education attained among older women involved in the Indiana Extension Homemakers Association. This chapter presents a review of the literature that describes the following: demographics and health status of older adults, nutritional concerns and needs of older adults, factors influencing food choices and dietary habits of older adults, the relationship between nutritional knowledge and health status of older adults, and program involvement among older adults.

Demographics and Health Status of Older Adults

Demographics

In 2008, there were 38.9 million older adults aged 65 years old and above, which is an increase of 13 percent or 4.5 million since 1998 (AoA, 2009). Advanced technology and knowledge, especially in the health care and medical field, has helped extend the life expectancy of the older population. This increase can also be attributed to the decrease in mortality of children and young adults. The number of Americans aged 45-64, who will reach the age of 65 over the next two decades has increased by 31 percent during this
decade (AoA, 2009). Furthermore, it is projected that the older adult population, 65 years old and over, will increase to 55 million in 2020 (“Decennial census,” 2008). In 2008, 19.6 percent of people above the age of 65 years were minorities – 8.3 percent were African Americans, 6.8 percent were of Hispanic origin, 3.4 percent were Asian or Pacific Islander, and less than one percent were American Indian or Native Alaskan (“Decennial census,” 2008).

In 2008, 77 percent of the older population had graduated from high school and 21 percent held a bachelor’s degree or higher. This is a drastic increase from the older population in 1965, when only 24 percent graduated from high school and five percent had a bachelor’s degree ("Current population: 1966-2008," 2008). Widowhood is more commonly seen among older women than older men ("Older Americans 2010," 2010); about 42 percent of all older women are widowed ("Current population: 1966-2008," 2008). Factors such as low education and poor living arrangements have been associated with increased risk of malnutrition, chronic diseases and conditions, and decreased quality of life.

While a small number (1.60 million) of older adults live in institutional settings, the number increases with age; 1.3 percent of institutionalized adults were 65–74 years old, 3.8 percent were 75–84 years old, and 15.4 percent were 85 years and above ("Current population: 1966-2008," 2008). It is instrumental to the quality of life of older adults to have effective prevention strategies that target healthy dietary and physical activity habits, and aim to prevent disease and disability consequences. Positive behavior changes towards a healthy lifestyle can increase self-sufficiency and extend the age in which older adults enter an institutional setting.
Poverty level, income, and education level are intrinsically related to each other; population groups that suffer the worst health status are also those that have the highest poverty rates and the least education ("Current population: 1966-2008," 2008; “Decennial census," 2008). To determine poverty, the U.S. Census Bureau compares family income with a set of poverty thresholds that vary by family size and composition ("Older Americans," 2010). Almost 3.7 million older adults were below the poverty level in 2008 ("Current population: 1960-2008," 2008). Zoellner, You, Connell, et al. (2011) evaluated health literacy skills in relation to Healthy Eating Index (HEI) scores and sugar-sweetened beverage (SSB) consumption along with demographic variables; sex, race, education level, and income level (Zoellner et al., 2011). Of 376 adult participants, 67.6% were African American, 71.5% were without a college degree, and 55.0% had a household income of <$20,000/ year. Results showed that age, sex, and participation in Supplemental Nutrition Assistance Program were significant predictors to HEI scores; education level and income were not significant predictors for SSB. Health literacy significantly predicted SSB consumption, while accounting for demographic variables (Zoellner, et al., 2011). Federal, state, and county funded programs help assist older adults in many facets including: financial assistance, home-delivered meals, education materials, and nutrition programs.

Health Status

Recognizing that nutrition is a major modifiable risk factor for chronic diseases and related complications in older adults, nutrition is instrumental in prevention strategies. The most common chronic diseases include heart disease, stroke, cancer, and diabetes (Centers for Disease Control and Prevention [CDC], 2008). Chronic health
conditions negatively affect quality of life by contributing to the decline in health status, the inability to remain in the community, and functional (physical) limitations. In 2007, older women reported more problems with physical functioning (stoop/kneel, lift 10 lbs, walk 2-3 blocks, write, and reach over head) than older men. Difficulties with activities of daily living (ADL) among older adults increased with age ("Medicare Current," 2007). Functional limitation is addressed in the initiative, Healthy People 2020 objective (OA - 5) –Reduce the proportion of older adults who have moderate to severe functional limitations ("Healthy People 2020," 2010). In 2007, the baseline of older adults who had moderate to severe limitations is at 28.3 percent and the target goal for Healthy People 2020 is set at 25.5 percent ("Healthy People 2020," 2010).

**Diet Quality**

Measured by the Healthy Eating Index-2005, from 2003-2004 the average diet of older Americans met or exceeded the federal diet quality standard for whole fruit, total grains, and meat and beans. However, the following HEI-2005 components fell short in the following areas: total fruit, total vegetable, and dark green/orange vegetables and legumes, whole grain, milk, and oils ("Older Americans," 2010). The average intake of saturated fat, sodium, calories from solid fats, alcoholic beverages, and added sugars were over consumed and the older adults failed to meet the quality standards ("Older Americans," 2010). Vitolins, Tooze, Vitolins, et al. (2007) evaluated dietary quality of rural older adults (n=122) using the HEI-2005 by conducting five to six 24-hour recalls at monthly intervals over a six month period; participants were 65 to 93 years of age, had twelve or less years of education, and had low income (Vitolins et al., 2007). Results indicated most participants did not meet the minimum recommended servings for grains.
(eating less than 1/8 whole grains), fruits, vegetables, and dairy. Results showed a statistical significant interaction between education and sex (P= 0.021), which indicates that among the participants with an eighth-grade education or less, the men had a mean HEI score that was significantly less than those of women. Also, among those participants with an education above the eighth-grade level, the men had a mean HEI score that was less than those women, but not at a significant level (Vitolins, et al., 2007). Benefits of seeking a healthy lifestyle can be seen at any age. While life expectancy has increased, so has the prevalence of chronic health conditions like hypertension, diabetes, stroke, and obesity (CDC, 2008). Not only can nutrition education increase awareness and knowledge about chronic health conditions, but also gives older adults opportunities to stay active and involved, both mentally and physically.

**Nutrition Concerns and Needs for Older Adults**

Nutrition is an important element of health in the older population and affects the aging process. The prevalence of malnutrition among the older population is increasing and is associated with a decline in functional status, impaired muscle function, decrease bone mass, various gastrointestinal disorders, immune dysfunction, anemia, reduced cognitive function, poor wound healing, delayed recovery from surgery, higher hospital readmission rates, and mortality (Ahmed & Haboubi, 2010; Baker, 2007).

Nicolas, Faisant, Lanzmann-Petithory, Tome, and Vellas (2000) examined the nutritional intake from a three-day food record of non-institutionalized, healthy older adults (aged 60 years old and over; n=96) at a four year interval. Results showed a significant decrease in calcium (983.4 mg ± 279.5 mg to 897.1 mg ± 300.5 mg;
representing an 8.8% decline) at the four year interval; a significant decrease in carbohydrate intake (46.6 gm ± 6.8 gm to 43.9 gm ± 6.8 gm; representing a 2.7% decline); and a significant increase in fat intake (32.1 gm ± 6.3 gm to 35.0 gm ± 6.3 gm; representing a 9.0% increase) among women participants (Nicolas et al., 2000). Even though nutrients such as protein, fiber, iron, vitamin A, and vitamin E decreased, the results were not significant (Nicolas et al., 2000). By showing healthy aging associated with a mean caloric intake close to 29 kcal/kg/d (near the upper limits of the recommendation of 25-30 kcal/kg/d) and with protein intakes near 1.2 g/kg/d (higher than the Dietary Reference Intake of 0.8 g/kg/d), these researchers help better define the nutritional requirements of the elderly and how aging can affect these requirements.

‘Anorexia of Aging’

Ahmed and Haboubi (2010) discussed causes of the concept ‘anorexia of aging’ including physiological changes (hormonal, cytokines, changes in GI tract, decreased sensory), decreased energy expenditure, decreased physical activity, and pathological changes (medical, drugs, psychological, and social) (Ahmed & Haboubi, 2010). In addition, pathologic changes of aging such as chronic diseases and psychological illness all play a role in the complex etiology of malnutrition in older people. Therefore, it is important for older adults to 1) be aware of the changes that can and will occur, 2) have adequate nutritional knowledge to know how to make healthful changes, and 3) implement positive, healthful changes into a lifestyle. Changes that can occur in the gastrointestinal tract include: oral health problems (improperly fitted dentures, gingivitis, and missing teeth), reduced gastrointestinal motility, reduced volume of digestive juices, and atrophic gastritis. These changes can be attributed to poor appetite, reduced food
intake, and reduced absorption of nutrients such as folic acid, vitamin B12, calcium, iron, and beta-carotene (Brownie, 2006). Chronic diseases, altered sensory function, and changes in fluid regulation can also result in dehydration, delirium, dementia, decreased mobility, altered nutrient absorption, decreased energy, and improper food choices (Brownie, 2006). Fluid deprivation and repletion studies that compare young adults with older adult subjects have shown older people do not consume adequate amounts of fluid to maintain ideal plasma electrolyte concentrations, resulting in possibly detrimental effects on health status (Rolls & Phillips, 1990).

While the concept of ‘anorexia of aging’ suggests and can relate to unintentional weight loss, according to NHANES 2003-2004, 71 percent of older adults (aged 60 years and older) were overweight or obese (Ogden et al., 2006). The effects of overweight and obesity on chronic health conditions and mortality show a higher prevalence of frailty, low physical function, greater decline in physical function, and earlier onset of physical disability among older adults with high BMI, waist circumference, and percentage body fat (Villareal, Banks, Siener, Sinacore, & Klein, 2004; Baumgartner et al., 2004; Houston, Nicklas, & Zizza, 2009). Unintentional weight loss in overweight and obese older adults is a serious concern for health care professionals; the association of unintentional weight loss in older adults, which usually is accompanied with other age-related diseases and conditions.

Another major age-related physiological change in older adults is the decline in skeletal muscle mass resulting in sarcopenia (Ahmed & Haboubi, 2010; Brownie, 2006). Deterioration of the central nervous system, reduced motor neuron innervations to muscles, a decline in muscle cell contractility, and reduced circulating levels of anabolic
hormones including testosterone, estrogen, and growth hormone are all factors and proposed physiological mechanisms that have been suggested for the cause of sarcopenia (Brownie, 2006). The prevalence of obesity is difficult to reconcile with sharply lowered energy intakes. While basal metabolic rate (amount of energy expended daily at rest) does decline with age, lack of physical activity among older adults is also a probable explanation. The lack of physical activity only exacerbates the process of muscle atrophy, loss of lean muscle tissue, and increase adiposity.

**Vitamin D Status and Status of other Nutrients**

Vitamin D insufficiency can also be a problem for older adults because synthesis of Vitamin D in the skin becomes less efficient as aging continues. Insufficiency is also likely due to spending excess amounts of time indoors and not consuming adequate vitamin D from food sources (Institute of Medicine, 2010). About 90 percent of the vitamin D requirements come from exposure (Millaneschi, 2010). Research has shown positive effects of vitamin D on physical performance and may be attributed to its action on the nervous system, improving balance, and neuromuscular control and coordination (Annweiler, Schott, Berrut, Fantino, & Beauchet, 2009; Millaneschi, 2010). Roughly half of older adults in the U.S. with hip fractures may have serum 25-hydroxyvitamin D [25(OH)D] levels <30nmol/L. (Cranney et al., 2007). Since fractures and fall risks are serious concerns for older adults, it is important to maintain sufficient vitamin D status because of the vitamin D role in bone health.

Seamans et al. (2010) assessed vitamin D status, reflected by serum 25-hydroxyvitamin D [25(OH)D], in older adults (n=387; aged 55-87 years) and its association with cognitive function. Researchers found that serum 25(OH) D was
significantly and inversely correlated with assessments of the spatial working memory test parameter using a comprehensive Cambridge Neuropsychological Testing Automated Battery (Seamans et al., 2010).

Along with vitamin D, other nutrients such as fiber, protein, vitamin B-12, water/fluid, and physical activity recommendations such as strengthening and flexibility exercises may require special considerations (Houston, et al., 2009). A low fiber diet, seen in many diets of older adults, plays a key role in constipation. Consuming enough protein from animal products provides all essential amino acids that may help with loss of muscle mass (sarcopenia) versus from vegetables or other sources that tend to be deficient in one or more essential amino acids. Older adults are also at greater risk of malabsorption of food-bound vitamin B-12 and should consume foods fortified with vitamin B-12 or ingest supplementation to decrease risk of deficiency. Adequate intake of water and fluids are important for older adults because the sensation of thirst can decrease with age, therefore increasing the risk of dehydration. To maintain health and physical independence, it is important for older adults to engage in physical activity such as strengthening and flexibility exercises. These exercises help maintain and improve balance, which can help decrease risk of falls (Houston, et al., 2009; Davies, 2011).

**Factors Influencing Food Choices and Dietary Habits of Older Adults**

There are many different factors and determinants that influence everyday choices like eating habits and behaviors. For this literature review, older adults will be examined
to determine physiological, social, economic, and environmental factors that influence
the quality of life, food choices, and eating behaviors.

Through a focus group of 37 non-institutionalized older adults ages 60 and older, Duerr (2003) found the most influential people and organizations when it comes to sources of nutrition advice included health care organizations and professionals; religious, support, and social groups and; family, friends, and other associates (Duerr, 2003). Additional influential sources are the supportive services of communities and the individual themselves’ intrinsic motivation (ADA, 2005). Participants did recognize that good nutrition, life-style activities, social relationships, and mental activities were all major contributors to good health (Duerr, 2003). Factors such as hunger, poverty, education, inadequate food and nutrient intake, social isolation, depression, oral/swallowing problems, urban/rural geographic area, and/or diet-related acute/chronic diseases are manifold and often synergistic (ADA, 2000; "Current population: 1966-2008," 2008).

Dean, Raats, Grunert, et al. (2009) explored the influence of resources of food-related goals on the variety of food choices by administering a questionnaire-based survey among non-institutionalized older people, 65 years and older (n=3200). Results showed a positive correlation between predictor variables: monthly income with car availability (r= 0.40), good dental health (r= 0.29), and perception of good income (r= 0.53), and negative correlation with the goal of keeping expenditure low (r= -0.40). There was a positive correlation with physical health and mental health (r= 0.37), perception of good health (r= 0.58), and perceived mobility level (r= 0.53). Having a good income was positively correlated with having access to high-quality products/brands (r= 0.33). Food
knowledge, access to convenient food products, access to good food service provider, access to high-quality products, and support from friends/neighbors were shown to be significant predictors of a varied diet (Dean, Raats, Grunert, & Lumbers, 2009). This research can suggest that increasing older persons’ nutrition knowledge through an instructional class (i.e. cooking class) and/or information provisions may influence food choices by increased consumption of a varied diet.

Feldblum, German, Castel, et al. (2007) identified factors contributing to the variability between patients at nutritional risk, defined by the Mini Nutritional Assessment (MNA-SF), and malnourished older adults (aged 65 years and older; n=259). Results showed the malnourished group (18.5% of participants) were less educated, had a higher depression score, and lower cognitive and physical functioning. Higher prevalence of chewing problems was seen in this group compared to the at risk group. Lower cognitive function, education less than 12 years, and chewing problems were all risk factors for malnutrition (Feldblum et al., 2007). Being malnourished showed how many factors work synergistically to affect nutritional status of older adults.

**Relationship between Nutrition Knowledge and Health Status of Older Adults**

Elbon, Johnson, Fischer, and Searcy (2000) examined 1) the use of nutrition labels to identify calorie, protein, cholesterol, saturated fat, and calcium content of foods and 2) to identify factors associated with reading nutrition labels, by surveying 475 older adults aged in their 60s (n=151), 70s (n=183), and 80s (n=141). Results indicated higher education level (p≤ 0.0001) and being female (p≤ 0.003) had the strongest association with higher label reading score (Elbon, Johnson, Fischer, & Searcy, 2000). Researchers
found a positive correlation between nutrition label reading and health-seeking behaviors, such as reducing cholesterol intake, reducing fat intake, and consuming enough calcium; these results were negatively associated with advancing age (Elbon et al., 2000). Although this study does not look at health status, understanding and reading the nutritional label when purchasing food items may be associated with purchasing healthy, nutrient dense foods and positive, healthy dietary behaviors.

Leigh, Richardson, Beck et al. (1992) analyzed the effectiveness of a 12 month health promotion program for retirees; this study was aimed at cutting insurance costs. Leigh, et al. found a low-cost health promotion program was effective in changing health behaviors and had potential to decrease health care utilization (Leigh et al., 1992). Later, Fries, Bloch, Harrington et al. (1993) extended the study and analyzed the health promotion program for 24 months. Researchers looked at the effectiveness of a 24 month health promotion program that focused on reducing health risk among older adults (n=4,712). Researchers found health risk scores were significantly decreased when health risk appraisals, recommendation/feedback letters, and educational materials were consistently given over the 24-month period. The health promotion program showed improvement in health risk status and reduction of costs (Fries et al., 1993).

Patacca, Rosenbloom, Kicklighter, and Ball (2004) determined older adults’ aged 60 years and over, to have attitudes and opinions toward a nutrition education program by conducting six, 45 minute focus groups in six different congregate meal sites (n= 28). This followed up their previous study, which involved examining nutrition knowledge after nutrition education lessons using a pre-test, post-test method. Researchers focused on topics addressing opinions towards nutrition education, reason for participating,
outcomes following the program, and suggestions for future programs (Patacca, Rosenbloom, Kicklighter, & Ball, 2004). Some participants believed nutrition education is confusing, but all participants would participate in nutrition education in the future. The majority said they had changed/developed better dietary behavior(s) as a result of the nutrition education program and planned on continuing the new habit(s) (Patacca et al., 2004).

Kim (2008) examined the influence of expectations of aging on physical and mental health status, and the mediating effects of health promoting behavior on the relationship between these expectations and physical and mental health among older adults (Kim, 2009). The questionnaire measured three domains – physical health, mental health, and cognitive function – based on a short version of the Expectations Regarding Aging (ERA) questionnaire, Health Promoting Lifestyle Profile II, and Medical Outcomes Study. Results indicated females believed they have poorer physical health status ($\beta=-0.26$, $P<0.05$), but not poorer mental health ($\beta=-0.13$, $P<0.05$) than males. When covariates (age, gender, and education) were factored in, the concept of expectations regarding aging (ERA- high levels of physical and mental functioning with aging) was associated with better physical health ($\beta=0.27$, $P<0.01$) and mental health status ($\beta=0.64$, $P<0.001$). The effect of ERA on physical and mental health status, controlling for health-promoting behavior, was significantly reduced ($\beta=0.33$, $P<0.01$ to $\beta=0.52$, $P<0.001$) (Kim, 2009). With the prevalence of health problems with nutritional implications among this population, it is suggested there are significant health benefits to be gained from nutrition education; especially when targeted at different stages of
prevention. By testing the knowledge of older adults, it can help determine if accurate concepts of nutrition are understood.

**Nutrition Screening Tool**

Nutrition education provides general information about foods and nutrients, diets, lifestyle factors, community nutrition resources and services to people to improve their nutritional status. Nutrition education can address problems like weight management, nutrition related diseases (i.e. diabetes), skipping meals, inadequate fruit or vegetable intake, difficulties with grocery shopping or cooking, and/or poor food budgeting. Almost all older people can benefit from nutrition education, but some have greater needs than others. The DETERMINE Your Nutritional Health Checklist is one of the many tools that can help identify those older adults who would benefit from nutrition education, due to their increased nutritional risk, and those who may require more intensive nutritional counseling and support (*Nutrition Intervention Manual*, 1992). The DETERMINE Checklist quickly screens people based on nine warning signs: disease, eating poorly, toothless/mouth pain, economic hardship, reduced social contact, multiple medicines, involuntary weight loss/gain, needs assistance in self care, and elder years above age 80 (*Nutrition Intervention Manual*, 1992).

Siudara, Perrino, Miller, and McManus (1993) developed the “Bringing Better Nutrition to Older Adults Project” that targets healthy, mobile seniors and frail, homebound seniors involved in the Older Persons’ Commission (OPC) senior center and who are considered high risk of nutrition problems. Researchers applied the DETERMINE Checklist to evaluate the nutritional condition of participants (n=200) and found 50 percent were at risk for malnutrition and were then referred to a registered
dietitian for further assessment using NSI’s Level I and Level II Screens. This resulted in the development of nutrition education classes at the senior center and the implementation of medical nutritional products as a part of the daily home-delivered meals program for participants at risk for malnutrition (Siudara et al., 1993). Results indicated 69 percent of participants who were underweight had increased in weight and 22 percent of the participants who had been losing weight had stabilized within eight months (Siudara, 1993). Assessing nutritional status or risk of malnutrition is important to nutrition education programs because it can help identify needs of the target population, justify and support the need for implementation of a program in a community, and justify the need for funding (Siudara, 1993). The DETERMINE Checklist nutritional screening tool is one of the most widely studied and validated instruments for screening risks of malnutrition in the older population (Gallagher-Allred, 2011; Nutrition Intervention Manual, 1992).

**Program Involvement among Older Adults**

Programs, organizations, groups, and clubs that are appropriately designed for older adults are essential for effective and active participation among older adults. A Healthy People 2010 objective for older Americans was to increase to at least 90 percent the proportion of people aged 65 and older who have participated during the preceding year in at least one organized health promotion program (any health class, presentation on a health-related topic, exercise class, or exercise program) (Drewnowski, 2001). The Educational and Community-Based Programs objective (ECBP-10) for Healthy People 2020, aims to increase the number of community-based organizations—including local
health departments, tribal health services, nongovernmental organizations, and State agencies –providing population –based primary prevention services in the area of nutrition (objective ECBP-10.8) ("Healthy People 2020," 2010). At baseline, only 86.4 percent of community-based organizations provided population-based primary prevention services in nutrition in 2008. The target goal set for Healthy People 2020 is an improvement to 94.7 percent ("Healthy People 2020," 2010).

**Topics of Interest**

Appropriate topics that would engage older adults were found to be nutrition basics (e.g.) on number of meals, calories, and fats; diet and diseases (e.g. on obesity, diabetes, and heart disease); life-style habits/problems (e.g. on fixed incomes, weight loss/gain, and food safety); supplements; and general education and application in everyday situations (e.g. on restaurant eating and cooking class) (Duerr, 2003). Determining the wants and needs of older adults can help guide nutrition programs to develop topics that will not only interest this population, but also increase knowledge and reinforce healthy dietary and life-style habits.

Keller et al. (2005) conducted an evaluation of a single or three session series of nutrition-based workshops to determine if it met the nutritional education needs of older adults. Participants reported increased knowledge, confidence in cooking, and increased motivation to make healthier changes. Participants also deemed the materials and nutrition education lessons very appropriate for older adults (Keller, et al., 2005). Gaining nutritional knowledge does not guarantee behavior change because it depends heavily on participant’s motivation for change. Therefore increasing nutritional knowledge (by
means of demonstrations, materials, and lectures) can increase the probability for a positive, healthful behavior change that leads to a better quality of life.

Support Programs such as Cooperative Extension Services and Other Programs

The Cooperative Extension Service in West Virginia explored the relationship between leadership skills and the Extension volunteer and service organizations (also known as the Extension Homemakers/Educational Outreach Service (CEOS) (Ohnoutka, 2005). The study of Extension Homemakers/Educational Outreach Service (CEOS) groups of West Virginia was aimed to determine the benefits of membership. The population studied was 67 percent married, 99.4 percent females, 45 percent with high school diplomas, and 95 percent white/non-Hispanic. Results indicated the following as benefits to membership: leadership (committee membership, holding an office, public speaking), teaching (lesson teaching and facilitating, planning events), personal efficacy (self-confidence, life-long learning), and networking. Other reasons for membership were identified such as connections and social interactions; keeping up-to-date on educational information on emerging issues such as public policy, health, nutrition and diet, and financial planning (Ohnoutka, 2005).

Iowa’s Cooperative Extension Service program, Peer NETWORK, addressed the needs of homebound-older adults by stimulating interest in and awareness of adequate dietary intake and establishing a network of older peers with sound nutrition information to provide a strong support system (Hans, 1992). In a peer support group setting, Haber and Lacy (1993) examined if peer groups influenced behavior change in older adults (n=64) by conducting a ten week education program covering topics like exercise, stress management, diet and nutrition, and medications on heart health. Researchers found the
intervention group (peer support groups) reported significantly positive changes in their fiber and sodium intake behaviors (Haber, 1993). With the addition of the peer support groups to nutrition education program, it can provide the social interaction and guidance that older adults may need in order to take steps towards making healthful behavior changes.

**Summary**

Nutrition education programs and materials are available from several national profession organizations and service agencies including hospital food and nutrition departments, health departments, aging service departments, senior centers, county Extension Services, and national health organizations (*Nutrition Intervention Manual*, 1992). That is why it is important to make sure programs are successful and beneficial to the target audience. Gathering information on demographics and health status, nutritional concerns and needs, factors influencing food choice and dietary habits, and the relationship between nutritional knowledge and health status is very important when establishing an appropriate nutritional education program for older adults. The IEHA is a very specific audience that provides opportunities for members to learn about nutrition through their education topic area programs. Little research has been done on this group, justifying the purpose of this study to determine nutrition knowledge in relation to nutritional risk, age, and education level among older women involved in the Indiana Extension Homemakers Association.
CHAPTER THREE

METHODOLOGY

The purpose of this study was to examine the extent of nutrition knowledge of older women involved in the Indiana Extension Homemakers Association and compare this to the IEHA participants’ nutritional risk level, age, and levels of education attained. This study determined if there were any relationships between nutrition knowledge scores and age subgroups of older adults. Also, age subgroups and nutritional risk levels were explored to determine any interactions with regard to differences in nutrition knowledge score. This chapter describes the sample, instruments, and methods used to conduct the study.

Sample

The study included women over the age of 55 years and who participate in the Indiana Extension Homemakers Association of Shelby County. In this study, 55 years and above was considered older adult, although the definition of a ‘young-old’ age subgroup is 65-74 years of age (ADA, 2000). The researcher sought a wider age demographic since they all participate in IEHA; also, this study was considered a nutritional awareness screening for people not yet 65 years of age. The researcher
introduced and recruited the study to the club presidents at the IEHA county council meeting. There are 17 Shelby County Extension Homemaker clubs and the first two club meetings that were held were part of the pilot study. Examination of membership data revealed a total of 208 females involved in the IEHA of Shelby County group.

The researcher attended the club meetings and explained to participants the study’s purpose, what kind of surveys/questionnaires they would be taking, and how participating in this study could help expand information relating to the purpose of the study. The researcher distributed and facilitated the administration of the surveys/questionnaires, answered any questions participants had, and collected surveys/questionnaires.

The subjects were selected through a convenience process. This method was employed because of the accessibility of potential participating subjects. Participants’ questionnaires were excluded due to not meeting age requirements, and/or not members of the Indiana Extension Homemakers Association.

**Instruments**

*Nutrition Health Status*

The instrument that was used to determine nutrition health status was the Nutrition Screening Initiative Determine Checklist (Appendix D) (*Nutrition Screening Initiative, 1992*). Posner, Jette, Smith, and Miller (1993) examined the relative importance of the DETERMINE Checklist items in predicting nutrient intake and health outcomes, making recommendations for item weights in the Checklist, and estimated the distribution of nutrition risk level scores in a noninstitutionalized older population.
Researchers found the survey to be a brief, easily scored instrument that could accurately identify noninstitutionalized older persons at risk for low nutrient intake and health problems (Posner, et al., 1993). Also questions about age, race, and education level were asked. These demographic questions were asked and set up based on U.S. Census standards (“People and Households,” 2010).

Nutrition Knowledge Questionnaire

This nutrition knowledge questionnaire (Appendix E) was developed based on the Dietary Guidelines for Americans 2010 and also modified from a questionnaire developed by Parmenter and Wardle (1999) in a study that described the development of a reliable and valid questionnaire to provide a comprehensive measure of the nutrition knowledge of UK adults (Parmenter & Wardle, 1999). Parmenter and Wardle’s instrument helped to identify areas of weakness in people’s understanding of healthy eating and also provided useful data for examining relationship between nutrition knowledge and dietary behavior (Parmenter & Wardle, 1999).

The U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS) focus on health promotions and disease risk reduction, and the Dietary Guidelines form the basis for nutrition policy in Federal food, education, and information programs ("Dietary Guidelines for Americans 2010," 2011). The Dietary Guidelines for Americans 2010 is the most updated recommendation by health experts of the USDA and HHS; therefore the nutrition knowledge questions were developed to adhere to these guidelines. This nutrition knowledge questionnaire was also examined and critiqued by a panel of nutrition experts employed by Ball State University. The current researcher omitted and altered some of the questions to better relate to the target
audience; focusing on B-12, vitamin D, dietary fiber, cholesterol, iron, fluids, cooking methods, and physical activity topics geared towards the older adults. The nutrition knowledge questionnaire was tested during the pilot study to ensure validity and accuracy.

**Letter of Permission**

A letter of approval (Appendix B) from the Extension Educator of Health and Human Sciences, Mrs. Diana Stone, was attained for the presentation of the researcher’s study to the IEHA-Shelby County Council meeting.

**Methods**

*Pilot Study*

The pilot study was conducted at IEHA meeting in Shelby County, Indiana. As previously mentioned the participants were women over the age of 55 years and were administered the Nutrition Screening Initiative Determine Checklist with demographic survey and the nutrition knowledge questionnaire. Two Shelby County Extension Homemaker clubs, 24 participants, were surveyed for the pilot study. They were considered convenience groups because their club meeting was the first upcoming event during the data collection process.

*Research Study*

The researcher attended the club meetings and explained to participants the study’s purpose, what kind of surveys/questionnaires they would be taking, and how participating in this study would be helping the researcher’s purpose. The researcher was
present to distribute and facilitate the surveys/questionnaires, answered any questions participants had, and collected the surveys/questionnaires. The pilot study helped to identify any confusing or misleading statements and also helped identify any other potential factors that needed to be modified (environmental, administration process, verbal or written communication) preceding the planned study.

The pilot study was conducted under the same conditions of the study. Since no changes were made to the survey based on the results from the pilot study, the 24 participants were included in the actual study.

**Statistical Analysis**

Data were analyzed using IBM SPSS v.19.0 for Windows (IBM SPSS, Inc., 2010). Descriptive statistics and frequency counts were computed on all variables. Frequency counts (number and percent) were used to determine the overall prevalence of specific survey questions among participants. To determine the difference between nutrition knowledge according to the independent variables of nutritional risk level, and level of education attained, an analysis of variance (ANOVA) was used to test the null hypotheses; also correlations were used within this study. Statistical significance was set at $\alpha=0.05$.

**Institutional Review Board**

Permission was granted from Ball State University Institutional Review Board for the implementation of this pilot study and study (Appendix A-1). The researcher also completed the Collaborative Institutional Training Initiative training (Appendix A-2).
CHAPTER FOUR

RESULTS

The purpose of this study was to examine the extent of nutrition knowledge of older women involved in the Indiana Extension Homemakers Association (IEHA) and compare this to the IEHA participants’ nutritional risk level, age, and level of education attained. This study determined if there was any relationship between nutrition knowledge scores and age subgroups of older adults. Also, age subgroups and nutritional risk levels were explored to determine any interactions with regard to differences in nutrition knowledge scores. This chapter will present the results obtained throughout the implementation.

Pilot Study Results

The pilot study consisted of 24 female participants, all members of IEHA. The average age of participants was about 73 years old; with 46% were above 75 years old (Table 1). All participants had at least a high school diploma; almost 71% graduated from high school, over 12% obtained a bachelors degree, nearly 8% attended college/technical school, and around 8% obtained a masters degree. All participants in the pilot study was
white, non-Hispanic. The group’s mean average score from the nutrition knowledge questionnaire was 11.5, SD 1.69; the questionnaire consisted of 15 questions.

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>N=24</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>Mean; range</td>
<td>73.2; 55-90</td>
</tr>
<tr>
<td>55-65</td>
<td>7</td>
<td>29.2</td>
</tr>
<tr>
<td>66-75</td>
<td>6</td>
<td>25.0</td>
</tr>
<tr>
<td>≥76</td>
<td>11</td>
<td>45.8</td>
</tr>
<tr>
<td><strong>Level of Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>17</td>
<td>70.8</td>
</tr>
<tr>
<td>College</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Bachelor</td>
<td>3</td>
<td>12.5</td>
</tr>
<tr>
<td>Master</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Nutritional Risk Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No/low Nutritional Risk</td>
<td>7</td>
<td>29.2</td>
</tr>
<tr>
<td>Moderate Nutritional Risk</td>
<td>9</td>
<td>37.5</td>
</tr>
<tr>
<td>High Nutritional Risk</td>
<td>8</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>Race/Ethnic Background</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>24</td>
<td>100.0</td>
</tr>
<tr>
<td>Hispanic/ Latino American</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The questions generated for the Nutrition Knowledge Questionnaire were mainly based on the new Dietary Guidelines for Americans ("Dietary Guidelines for Americans 2010," 2011) and aimed towards food and nutrition needs and challenges of older adults. The following results were reported starting from highest percentage missed.

The Dietary Guidelines for Americans 2010 emphasize the importance of vitamin B-12 status as Americans age. Only four participants (20%) in the pilot group correctly answered “Which of the following is a good source of vitamin B-12? – Beef” (Table 2). This was the most missed question for the pilot study group. When asked to identify the
“good cholesterol”, only 41.6% answered HDL. The majority of participants correctly answered questions regarding factors that can increase blood pressure (70.8%), nutritious cooking methods (70.8%), a food source of iron (75.0%), hydration status (75.0%), and the role of fibers in the body (79.1%). Iron deficiency, low fibrous food intake, and dehydration are all common nutritional-related problems among older adults (Baker, 2007; Dietary Guidelines for Americans 2010," 2011). Almost all participants correctly answered questions regarding low-calorie skim milk (91.6%); identifying a starchy vegetable (91.6%), sugar substitutes (91.6%), and source of dietary fiber (95.8%). All participants (100%) knew that canola oil is healthiest for cooking.

Table 2

Pilot Study: Percent of Older Women Participants who Answered the Nutrition Knowledge Questions Correctly (n=24)

<table>
<thead>
<tr>
<th>Nutrition Knowledge Questions with Correct Response Beneath Question</th>
<th>Correct Answer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Older adults (60yr +) need _________________________________. FEWER calories than a younger adult (18-59 years old)</td>
<td>83.3</td>
</tr>
<tr>
<td>2. Which type of milk has the fewest calories per serving (1 cup)? Skim milk</td>
<td>91.6</td>
</tr>
<tr>
<td>3. What vitamin helps the body absorb calcium? Vitamin D</td>
<td>83.3</td>
</tr>
<tr>
<td>4. Which of the following is most likely the BEST source of dietary fiber? Whole grain bread</td>
<td>95.8</td>
</tr>
<tr>
<td>5. Which of the following can increase blood pressure? Both A&amp;B (too much sodium &amp; being overweight or obese)</td>
<td>70.8</td>
</tr>
<tr>
<td>6. Which of the following is a good source of vitamin B-12? Beef</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7.</td>
<td>Which of the following is healthiest for cooking?</td>
</tr>
<tr>
<td>8.</td>
<td>What do health experts call “good” cholesterol?</td>
</tr>
<tr>
<td>9.</td>
<td>Which one of the following is a starchy food?</td>
</tr>
<tr>
<td>10.</td>
<td>To help prevent chronic diseases, it is recommended that you engage in physical activity for ____ minutes on most days of the week.</td>
</tr>
<tr>
<td>11.</td>
<td>Which of the following foods is a good source of iron?</td>
</tr>
<tr>
<td>12.</td>
<td>Vegetable skin &amp; pulp provides _____ to help with digestion &amp; help keep you ‘regular’.</td>
</tr>
<tr>
<td>13.</td>
<td>What is the least nutritious way to prepare green beans?</td>
</tr>
<tr>
<td>14.</td>
<td>Which of the following statements below is INCORRECT?</td>
</tr>
<tr>
<td>15.</td>
<td>Which of the following is an example of a sugar substitute?</td>
</tr>
</tbody>
</table>

Item analysis of the nutrition knowledge questionnaire showed it was not a strong survey in regards to questions’ item properties. Questions and multiple choice answers were too broad and dissimilar that an analysis could not accurately compare questions between each other. The item analysis helps choose the items with the best statistical properties from the items. With an appropriate criterion measured, item analysis can be used to make judgments concerning whether an item discriminates between better performing participants and poorer performing participants. Item analysis seeks to identify items, which do not distinguish between high and low scorers. Rationale for the questionnaire was due to the relevancy and application of the questions to older adults,
therefore no questions were changed after conducting the pilot study. As previously mentioned, most topics in the questionnaire were emphasized in the Dietary Guidelines for Americans 2010, reviewed by a panel of nutrition/health and wellness experts, and appropriately selected based on demographics of this group. Demographics of participants were older women who lived in a rural city and were homemakers (Hancook, 1986). Based on the results of this study, questions that were frequently missed/more difficult can be used for the nutrition component of IEHA meetings as future nutrition education topics. Since no questions were changed and the demographics for the pilot study were very similar to the rest of the IEHA participants, the pilot study group was included in the research study.

**Research Study Results**

For the study, there were a total of 204 registered female participants of the IEHA of Shelby County group. Of the 17 registered clubs, eight agreed to be surveyed; 92 participants met the age requirements for the study. The average age of participants was about 69 years old (Table 3). All participants had at least a high school diploma; about 55% graduated from high school, almost 20% obtained a bachelors degree, about 11% attended college/technical school, and about 12% obtained a masters degree. Based on the DETERMINE Checklist, only 15% of participants were considered to be at a high nutritional risk level. Forty-two percent of participants were considered to be at no/low nutritional risk and at moderate nutritional risk level. Everyone in the study was white, non-Hispanic.
<table>
<thead>
<tr>
<th>Variable</th>
<th>N=92</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Mean; range 69.9; 55-90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>55-65</td>
<td>31</td>
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<tr>
<td></td>
<td>66-75</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>&gt;76</td>
<td>24</td>
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<tr>
<td>Level of Education Attained</td>
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<td></td>
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<tr>
<td>High School</td>
<td>51</td>
<td>55.4</td>
</tr>
<tr>
<td>College</td>
<td>11</td>
<td>12.0</td>
</tr>
<tr>
<td>Bachelor</td>
<td>18</td>
<td>19.6</td>
</tr>
<tr>
<td>Master</td>
<td>12</td>
<td>13.0</td>
</tr>
<tr>
<td>Nutritional Risk Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No/low Nutritional Risk</td>
<td>39</td>
<td>42.4</td>
</tr>
<tr>
<td>Moderate Nutritional Risk</td>
<td>39</td>
<td>42.4</td>
</tr>
<tr>
<td>High Nutritional Risk</td>
<td>14</td>
<td>15.2</td>
</tr>
<tr>
<td>Race/Ethnic Background</td>
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<tr>
<td>White</td>
<td>92</td>
<td>100.0</td>
</tr>
<tr>
<td>Hispanic/ Latino American</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The level of difficulty and response pattern of participants were examined in this study. The following results were reported starting from highest percentage missed.

When asked to identify a good source of vitamin B-12, only 17% of participants provided the correct response of beef (Table 4). The majority of participants (68%) answered broccoli as a good source of vitamin B-12. Participants were asked to identify the “good” cholesterol; about 56% answered correctly with HDL; while 40% of participants who answered incorrectly chose LDL. When asked about factors that can increase blood pressure, about 78% of participant answered correctly. About 95% of participants knew whole grain bread is the best source of dietary fiber when compared to brown bread, white bread, and white yeast rolls. When asked to identify which of the following is healthiest for cooking, around 96% of participants answered correctly with canola; the
remaining participants answered butter. Almost 98% of participants correctly answered ‘corn’ as a starchy food and another near 98% identified Splenda® as being the sugar substitute when compared to three other forms of sugar (cane sugar, 1%; brown sugar, 1%; and powder sugar). The nutrition knowledge questionnaire was then further examined in regards to other variables such as nutritional risk level, age, level of education.

Table 4

Percent of Older Women Participants who Answered the Nutrition Knowledge Questions Correctly (n=92)

<table>
<thead>
<tr>
<th>Nutrition Knowledge Questions with Correct Response Beneath Question</th>
<th>Correct Answer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Older adults (60yr +) need ______________________________________________________________________</td>
<td>81.5</td>
</tr>
<tr>
<td>FEWER calories than a younger adult (18-59 years old)</td>
<td></td>
</tr>
<tr>
<td>2. Which type of milk has the fewest calories per serving (1 cup)? Skim milk</td>
<td>90.2</td>
</tr>
<tr>
<td>3. What vitamin helps the body absorb calcium? Vitamin D</td>
<td>84.8</td>
</tr>
<tr>
<td>4. Which of the following is most likely the BEST source of dietary fiber? Whole grain bread</td>
<td>95.6</td>
</tr>
<tr>
<td>5. Which of the following can increase blood pressure? Both A&amp;B (too much sodium &amp; being overweight or obese)</td>
<td>78.2</td>
</tr>
<tr>
<td>6. Which of the following is a good source of vitamin B-12? Beef</td>
<td>17.4</td>
</tr>
<tr>
<td>7. Which of the following is healthiest for cooking? Canola oil</td>
<td>96.7</td>
</tr>
<tr>
<td>8. What do health experts call “good” cholesterol? HDL</td>
<td>56.5</td>
</tr>
</tbody>
</table>
9. Which one of following is a starchy food?
   - Corn

10. To help prevent chronic diseases, it is recommended that you engage in physical activity for ____ minutes on most days of the week.
    - 30

11. Which of the following foods is a good source of iron?
    - Dried beans

12. Vegetable skin & pulp provides _____ to help with digestion & help keep you ‘regular’.
    - Fiber

13. What is the least nutritious way to prepare green beans?
    - Boiling on top of stove for 45 minutes

14. Which of the following statements below is INCORRECT?
    - A person needs to hydrate (or drink water) only if she feels thirsty.

15. Which of the following is an example of a sugar substitute?
    - Splenda®

---

**Nutrition Knowledge and Nutritional Risk Level**

The difference between nutrition knowledge scores among older woman participating in IEHA (Indiana Extension Homemaker Association) according to their nutritional risk level was examined in this study. Preliminary analysis used the Levene’s test to test for equality of average nutrition knowledge scores with the levels of nutritional risk ($p > .050$) (Table 5a). The homogeneity of variance means the population variances, in each group, show equality; most commonly used test is the Levene’s test to check homogeneity assumption. For these tests, the null hypothesis is that variances are equal across groups; therefore when the null is rejected the variances are unequal and the assumption is not met for ANOVA. These tests tend to be very powerful, and there is
probably not cause for real concern until the null is rejected at p < .001, especially when
the sample size is large. For this study, the assumption for homogeneity was met,
therefore ANOVA was run (Table 5b). Results also showed that the nutrition knowledge
scores were inversely associated with the nutritional risk level (no/low, moderate, and
high) (Figure 1). The no/low level nutritional risk subjects scored higher on the
nutritional knowledge questionnaire than the two other levels of nutritional risks. The
high nutritional risk group had the lowest nutrition knowledge scores.

Table 5a

<table>
<thead>
<tr>
<th>Score</th>
<th>N</th>
<th>Mean ± SD</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/low Nutritional Risk</td>
<td>39</td>
<td>84.10 ± 9.62</td>
<td>1.54</td>
</tr>
<tr>
<td>Moderate Nutritional</td>
<td>39</td>
<td>80.67 ± 7.91</td>
<td>1.26</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
<td>70.48 ± 9.68</td>
<td></td>
</tr>
<tr>
<td>High Nutritional Risk</td>
<td>14</td>
<td>80.58 ± 9.96</td>
<td>2.58</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>80.58 ± 9.96</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Test of Homogeneity of Variances

<table>
<thead>
<tr>
<th>Score</th>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.015</td>
<td>2</td>
<td>89</td>
<td>.367</td>
</tr>
</tbody>
</table>
Data were found to be significantly different in the mean nutrition knowledge score between the different nutritional risk levels ($F: 2, 89 = 11.96, p < .001$) (Table 5b). A significant difference in the nutrition knowledge score was found when compared between the no/low nutritional risk level ($84.10 \pm 9.62, p < .000$) and high nutritional risk level ($70.48 \pm 9.68, p < .005$) as well as between the moderate nutritional risk level ($80.68 \pm 7.92, p < .001$) and high nutritional risk level (Table 5c). However, there were no differences between the low nutritional risk and moderate nutritional risk levels.
### Table 5b

**ANOVA Mean Nutrition Knowledge Scores among Nutritional Risk Levels**

<table>
<thead>
<tr>
<th>Score</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1913.56</td>
<td>2</td>
<td>956.78</td>
<td>11.96</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>7122.18</td>
<td>89</td>
<td>80.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9035.74</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 5c

**Multiple Comparisons: Nutrition Knowledge Score and Nutritional Risk Level**

Post Hoc Tests

<table>
<thead>
<tr>
<th>(I) DETERMINE: Nutritional Risk Level</th>
<th>(J) DETERMINE: Nutritional Risk Level</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/low Nutritional Risk</td>
<td>Moderate Nutritional Risk</td>
<td>3.41</td>
<td>2.02</td>
<td>.216</td>
</tr>
<tr>
<td></td>
<td>High Nutritional Risk</td>
<td>13.62&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.78</td>
<td>.000</td>
</tr>
<tr>
<td>Moderate Nutritional Risk</td>
<td>No/low Nutritional Risk</td>
<td>-3.41</td>
<td>2.02</td>
<td>.216</td>
</tr>
<tr>
<td></td>
<td>High Nutritional Risk</td>
<td>10.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.78</td>
<td>.001</td>
</tr>
<tr>
<td>High Nutritional Risk</td>
<td>No/low Nutritional Risk</td>
<td>-13.62&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.78</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Moderate Nutritional Risk</td>
<td>-10.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.78</td>
<td>.001</td>
</tr>
</tbody>
</table>

<sup>a</sup>The mean difference is significant at the 0.05 level.
Nutrition Knowledge and Level of Education Attained

The nutrition knowledge score was then analyzed in regards to the level of education attained by older women participating in IEHA. Results showed that the nutrition knowledge scores were different according to the level of education attained [high school (≤12 years), college (13-14 years), and bachelor’s degrees (15-16 years)].

High school graduates had an average nutrition knowledge score of 77%, those who attended college (associate's degree or took some college courses) had an average nutrition knowledge score of 82%, those who attained a bachelor’s degree had an average nutrition knowledge score of 86%, and those who attained a master’s degree (17+ years) had a nutrition knowledge score of 85% (Figure 2).

Figure 2

Means of Nutrition Knowledge Score of each Level of Education Attained
Preliminary analysis used the Levene’s test to test for equality of the average nutrition knowledge scores with the level of education attained ($p > .050$) (Table 6a). Therefore, the assumption for homogeneity was met and ANOVA was used for further analysis (Table 6b).

**Table 6a**

**Equality of Average Nutrition Knowledge Score and Level of Education Attained**

<table>
<thead>
<tr>
<th>Descriptives</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>N</td>
<td>Mean ± SD</td>
<td>Std. Error</td>
</tr>
<tr>
<td>High School</td>
<td>51</td>
<td>76.99 ± 9.64</td>
<td>1.35</td>
</tr>
<tr>
<td>College</td>
<td>11</td>
<td>82.42 ± 8.04</td>
<td>2.42</td>
</tr>
<tr>
<td>Bachelor</td>
<td>18</td>
<td>86.66 ± 7.23</td>
<td>1.70</td>
</tr>
<tr>
<td>Master</td>
<td>12</td>
<td>85.00 ± 10.68</td>
<td>3.08</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>80.58 ± 9.96</td>
<td>1.03</td>
</tr>
</tbody>
</table>

**Test of Homogeneity of Variances**

<table>
<thead>
<tr>
<th>Score</th>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.843</td>
<td>3</td>
<td>88</td>
<td>.145</td>
</tr>
</tbody>
</table>

There was a statistically significant difference in the mean nutrition knowledge score between the different levels of education attained; high school, college, bachelor, and master levels ($F: 3, 88 = 6.28, p < .001$) (Table 6b). Further analysis revealed the nutrition knowledge score was statistically significantly lower in the high school level of education attained (76.99 ± 9.64, $p < .001$) compared to bachelor level (86.66 ± 7.23, $p < .001$) and master level (85.00 ± 10.68, $p < .050$). There was no statistically significant
difference between the college level group and high school level, college, or master level (Table 6c).

Table 6b

ANOVA Average Nutrition Knowledge Score between each Level of Education Attained

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1594.73</td>
<td>3</td>
<td>531.57</td>
<td>6.28</td>
<td>.001</td>
</tr>
<tr>
<td>Within Groups</td>
<td>7441.01</td>
<td>88</td>
<td>84.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9035.74</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6c

Multiple Comparisons of Average Nutrition Knowledge Score and Level of Education Attained

<table>
<thead>
<tr>
<th>Dependent Variable: Score</th>
<th>(I) Level of Education Attained</th>
<th>(J) Level of Education Attained</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School</td>
<td>College</td>
<td>-5.43</td>
<td>3.05</td>
<td>.291</td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td></td>
<td>-9.67a</td>
<td>2.52</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td></td>
<td>-8.01a</td>
<td>2.95</td>
<td>.039</td>
<td></td>
</tr>
<tr>
<td>College</td>
<td>High School</td>
<td>5.43</td>
<td>3.05</td>
<td>.291</td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td></td>
<td>-4.24</td>
<td>3.51</td>
<td>.625</td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td></td>
<td>-2.57</td>
<td>3.83</td>
<td>.908</td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>Master</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td>High School</td>
<td>9.67a</td>
<td>2.52</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>College</td>
<td></td>
<td>4.24</td>
<td>3.51</td>
<td>.625</td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td></td>
<td>1.66</td>
<td>3.42</td>
<td>.962</td>
<td></td>
</tr>
<tr>
<td>Master</td>
<td>High School</td>
<td>8.01a</td>
<td>2.95</td>
<td>.039</td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td></td>
<td>2.57</td>
<td>3.83</td>
<td>.908</td>
<td></td>
</tr>
<tr>
<td>Bachelor</td>
<td></td>
<td>-1.66</td>
<td>3.42</td>
<td>.962</td>
<td></td>
</tr>
</tbody>
</table>

*aThe mean difference is significant at the 0.05 level.
Nutritional Risk Level: Age and Level of Education Attained

When nutritional risk level and the age of older women participating in IEHA was examined, a trend towards a direct correlation \((p=.053)\) although not statistically significant was observed (Table 7a). As the nutritional risk level rose in older women, years of age directly increased too. The results from nutritional risk level and level of education of participants indicated a significant correlation \((\alpha 0.001; 2\text{-tailed})\) (Table 7b).

Table 7a

<table>
<thead>
<tr>
<th>Correlation between Nutritional Risk Level and Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations</td>
</tr>
<tr>
<td>DETERMINE: Nutritional Risk Level</td>
</tr>
<tr>
<td>Pearson Correlation</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>92</td>
</tr>
</tbody>
</table>

Table 7b

<table>
<thead>
<tr>
<th>Correlation between Nutritional Risk Level and Level of Education Attained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonparametric Correlations</td>
</tr>
<tr>
<td>DETERMINE: Nutritional Risk Level</td>
</tr>
<tr>
<td>Correlation Coefficient</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Level of Education Attained</td>
</tr>
<tr>
<td>Correlation Coefficient</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>N</td>
</tr>
</tbody>
</table>

\(a\)Correlation is significant at the 0.01 level (2-tailed).
A crosstabs analysis was conducted to tabulate the results of level of education attained against nutritional risk level to examine how the variables interrelate. Fifty-one participants answered high school as the highest education level attained and almost half of those participants were at a moderate nutritional risk level. Among the eleven participants who attended college (years of education 13-14), no one was at a high nutritional risk level. Eighteen participants completed a four year degree (Bachelor’s Degree) and 12 completed a Masters Degree; for both groups, over half of those participants were at a no/low nutritional risk level and only one participant in the high nutritional risk level (Table 7c).

Table 7c

**Cross Tabulation of Level of Education Attained and Nutritional Risk Level**

<table>
<thead>
<tr>
<th>Level of Education Attained</th>
<th>DETERMINE: Nutritional Risk Level</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No/low Nutritional Risk</td>
<td>Moderate Nutritional Risk</td>
</tr>
<tr>
<td>High School</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>College</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Bachelor</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Master</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>39</td>
</tr>
</tbody>
</table>
Nutrition Knowledge Score: Nutritional Risk Level, Level of Education Attained, and Age

The affects of nutritional risk level, level of education attained, and age on nutrition knowledge score were examined on older women participating in IEHA (Table 8a). These variables were examined as a result of the literature review. Many studies examined nutrition knowledge with each of these variables, but there was limited research that examined all variables together. Results in the current study showed there was a statistically significant difference in the mean nutritional knowledge score between the different levels of nutritional risk (NutRisk) \((p < .050)\). Age nor level of education attained had an effect on mean nutritional knowledge score; therefore the only significant difference noted was when age and levels of education attained was analyzed in its subgroups separately. No significant interaction effects on nutrition knowledge score were found among nutritional risk level, age, and levels of education attained. There were no significant interaction effects between NutRisk by Age, NutRisk by Education, or Age by Education.
<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>4222.131(^a)</td>
<td>24</td>
<td>175.922</td>
<td>2.449</td>
<td>.002</td>
</tr>
<tr>
<td>Intercept</td>
<td>194100.966</td>
<td>1</td>
<td>194100.966</td>
<td>2701.661</td>
<td>.000</td>
</tr>
<tr>
<td>NutRisk</td>
<td>566.956</td>
<td>2</td>
<td>283.478</td>
<td>3.946</td>
<td>.024</td>
</tr>
<tr>
<td>Education</td>
<td>525.982</td>
<td>3</td>
<td>175.327</td>
<td>2.440</td>
<td>.072</td>
</tr>
<tr>
<td>CatAge</td>
<td>142.142</td>
<td>2</td>
<td>71.071</td>
<td>.989</td>
<td>.377</td>
</tr>
<tr>
<td>NutRisk * Education</td>
<td>418.904</td>
<td>5</td>
<td>83.781</td>
<td>1.166</td>
<td>.335</td>
</tr>
<tr>
<td>NutRisk * CatAge</td>
<td>211.464</td>
<td>4</td>
<td>52.866</td>
<td>.736</td>
<td>.571</td>
</tr>
<tr>
<td>Education * CatAge</td>
<td>157.992</td>
<td>5</td>
<td>31.598</td>
<td>.440</td>
<td>.819</td>
</tr>
<tr>
<td>NutRisk * Education * CatAge</td>
<td>157.193</td>
<td>3</td>
<td>52.398</td>
<td>.729</td>
<td>.538</td>
</tr>
<tr>
<td>Error</td>
<td>4813.618</td>
<td>67</td>
<td>71.845</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>606400.000</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>9035.749</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) R Squared = .467 (Adjusted R Squared = .276)

The difference in the mean score on the nutrition knowledge score was only statistically significantly different among the 75 + year old, high school level participants who were at a high level nutritional risk (11.56±5.13, \(p < .050\)) (Table 8b).
### Table 8b

Pairwise Comparisons of Nutrition Knowledge Scores: Nutritional Risk Level, Level of Education Attained, and Age

<table>
<thead>
<tr>
<th>Dependent Variable: Score</th>
<th>Nutritional Risk</th>
<th>Education Attained</th>
<th>(I) Categorized Age</th>
<th>(J) Categorized Age</th>
<th>Mean Difference (I-J)</th>
<th>Sig.(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low/No NutRisk</td>
<td>No/low NutRisk</td>
<td>High School</td>
<td>65 - 74</td>
<td>55 – 64</td>
<td>2.487</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75+</td>
<td>5.000</td>
<td>.458</td>
</tr>
<tr>
<td></td>
<td></td>
<td>College</td>
<td>65 - 74</td>
<td>55 – 64</td>
<td>3.333</td>
<td>.651</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75+</td>
<td>10.000</td>
<td>.178</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bachelor</td>
<td>65 - 74</td>
<td>55 – 64</td>
<td>2.222</td>
<td>.749</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75+</td>
<td>-3.333</td>
<td>.749</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Master</td>
<td>65 - 74</td>
<td>55 – 64</td>
<td>5.000</td>
<td>.407</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75+</td>
<td>(b)</td>
<td>.</td>
</tr>
<tr>
<td>Mod NutRisk</td>
<td>High School</td>
<td>65 – 74</td>
<td>55 – 64</td>
<td>7.179</td>
<td>.269</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75+</td>
<td>3.179</td>
<td>.376</td>
</tr>
<tr>
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*Based on estimated marginal means*

\(^a\) Adjustment multiple comparisons: Least Significant Difference.

\(^b\) The level combination of factors in (J) is not observed.

\(^c\) The level combination of factors in (I) is not observed.

\(^d\) The mean difference is significant at the .05 level.
Summary

The following elucidates summary of the research hypotheses:

1. There was a significant difference between the nutrition knowledge score among older women participating in IEHA according to their nutritional risk levels. Data were found to be significantly different in the mean nutrition knowledge score between the different nutritional risk levels of no/low nutritional risk level compared with high nutritional risk level and moderate nutritional risk level compared with high nutritional risk level.

2. There was a significant difference between nutrition knowledge score according to the level of education of older women participating in IEHA. There was significant difference in the mean nutrition knowledge score between the difference levels of education attained; the nutrition knowledge score was significantly lower in the high school level of education attained when compared to bachelor level and master level of education attained.

3. There was no significant relationship between age and nutritional risk level of older women participating in IEHA, although there was a trend towards a direct correlation.
   
   a. There was a significant relationship between level of education attained and nutritional risk level of older women participating in IEHA.

4. There was no significant interaction between nutrition knowledge score and variables of nutritional risk, education, and age.
CHAPTER FIVE

DISCUSSION

The purpose of this study was to examine the extent of nutrition knowledge of older women involved in the Indiana Extension Homemakers Association and compare this to the IEHA participants’ nutritional risk level, age, and level of education attained. This study determined if there was any relationship between nutrition knowledge and age subgroups of older adults. Also, age subgroups and nutritional risk levels were explored to determine any correlations with regard to differences in nutrition knowledge. The discussion and limitations will be discussed in this chapter.

A panel of nutrition and health experts from Ball State University, from the Department of Physiology and Health Science and the Department of Family and Consumer Sciences, examined and reviewed the nutrition knowledge questionnaire. The appropriate changes were made in order to tailor the questionnaire to the subject participants. The IEHA focuses on topics, issues, and current events regarding women, aging, the home, and family (IEHA, 2012; Ohnoutka, 2005). The general demographics/characteristics of the subjects (majority old-elderly, small-town, rural, farming and/or 4-H background) (Hancock, 1986) also played a key role in selecting appropriate question topics, such as cooking methods, vitamin deficiencies/interactions,
and physical activity. After testing the nutrition knowledge questionnaire on the pilot subjects, the results showed the questionnaire was not a strong survey; in regards to questions’ item properties. In other words, questions and multiple choice answers were too broad and dissimilar that an analysis could not accurately compare questions between each other. The reason no questions were eliminated or changed for the study group from the pilot group was because each different question is tailored to the needs and specific recommendations of this population. With the Dietary Guidelines for Americans 2010 recommendations, new studies, and new research, there is a focus on the newly updated and important topics as physical activity, fiber, iron, B-12, and vitamin D among older adults (Seamans et al., 2010; Davies, 2011; Houston et al., 2009; "Dietary Guidelines for Americans 2010," 2011). Therefore older adults’ awareness and knowledge of these nutritional/health areas are important and key for prevention of nutritional deficiencies and overall health status (Duerr, 2003; Keller et al., 2005; Higgins & Barkley, 2004; Ohnoutka, 2005). Participants of IEHA are exposed to nutritional education lessons through the Shelby County Extension Service. Therefore, this information can be used to help develop nutrition education lessons based on commonly missed questions in the nutrition knowledge questionnaire.

The majority of questions were found to be “less difficult” (scored 80% or above), which was expected because participants have opportunities within their club to learn about health and nutrition. The response pattern of participants was further examined; this can help assess the effectiveness of current nutrition education lessons, determine future nutrition education topics, and determine funding of programming. The question regarding factors affecting of blood pressure, around 78 percent of participant answered
correctly (Table 4). A limitation to this question is that answer “C- both A & B” was correct. Participants could have read answer “A”, circled it, and moved on to the next question. Another limitation was within the question asking participants to identify the “good” cholesterol; in which about 56 percent answered correctly, HDL. Further examination of this question revealed the majority of those who answered incorrectly chose LDL. Since most participants did not choose trans-fats or saturated fats, researcher concluded participants may know that those fats should be eliminated/limited from the diet and failed to remember which (LDL or HDL) was the “good” and “bad” cholesterol. Only 17 percent of participants knew beef was a source of B-12; which is a common deficiency for older adults ("Dietary Guidelines for Americans 2010," 2011; Baker, 2007). These results are important for potential future nutrition education topics; so that the members of IEHA of Shelby County clubs, and similar groups, can receive the appropriate, relative information they need in hopes of improving overall health status.

The Determine Your Nutritional Health Checklist is a short, self assessment for nutritional risk. The survey serves in the clinical toolbox for geriatric care (The Nutrition Screening Initiative, 1992; Posner et al., 1993). The survey could also be used to assess other populations/demographics upon making small modifications to some survey questions. Modifications, or additional questions, could also be made to further understand an underlying problem. For example, if “I eat few fruits or vegetables, or milk products” was the most frequently circled survey question, then one could explore further by asking participants to identify which food group they eat few of. For this study, all survey questions were appropriate and related to the participants by the probability of being nutritionally at risk.
Although this study had a small group size and specific demographics, the results were pertinent to Shelby County and could possibly be applied to similar, surrounding counties of IEHA, who share similar demographics. Further, the guidelines and standards set by IEHA for clubs to adhere to, show a component of similarity/general likeness between clubs throughout Indiana; through programs, activities, and/or events (IEHA, 2012). Spangler and Eigenbrod (1995) used the DETERMINE Checklist and surveyed people with similar demographics to this study such as, older participants (60-90 years old), white/non-Hispanic (80%), Indiana residents; in which 33 percent came from small cities/rural towns, and an average of 12.8 years of education (Spangler & Eigenbrod, 1995). Spangler and Eigenbrod had 283 female participants that had similar nutritional risk levels to this study. More participants were no/low nutritional risk level (47%) and high nutritional risk level (19%) than this current study (42% no/low nutritional risk level and 15% high nutritional risk level). This current study had more participants in moderate nutritional risk level (42%) than researchers’, Spangler and Eigenbrod, study (33%). Results showed education was negatively correlated with nutrition risk level (Spangler & Eigenbrod, 1995). These results were similar to this study regarding education level and nutritional risk level; as the DETERMINE Checklist score increased, the level of education (years spent in school) was lower. The level of education attained could coincide with how knowledgeable people are in the areas of nutrition and health and wellness. Another factor that could influence nutrition knowledge is the source of where individuals get their nutrition information. As seen in Duerr (2003), older adults (60 years and older) were mostly influenced by an organization/social group when it comes to getting nutritional advice (Duerr, 2003). IEHA members can receive nutrition education...
lessons at club meetings; therefore it is important that those lessons/topics be 1) based on current, reliable research, 2) pertinent and relatable to the group, and 3) effectively taught so that nutrition knowledge and/or awareness increase.

Researcher expected the mean average scores for the nutritional knowledge questionnaire to decrease as participants nutritional risk level increased (Table 5a). These results indicated that participants with no/low nutritional risk did significantly better on the nutrition knowledge questionnaire than participants at a high nutritional risk level. Patacca et al. (2004) found the majority of participants 60 years or over had changed/developed better dietary behavior(s) and/or shown an increase in nutrition knowledge, as a result of the nutrition education program and planned on continuing the new habit(s) (Patacca et al., 2004; McClelland et al., 2001; Higgins & Barkley, 2003). Nutritional education programs may help increase the chance of developing a healthy/healthier habit, which in turn may lower the DETERMINE Checklist risk screening overall score.

A direct correlation between the level of education attained (high school, college, and bachelor’s degrees) and nutrition knowledge score was identified. Similar findings by Elbon et al. (2000) reported that, among older adults, higher education had the strongest association with higher nutrition knowledge score, nutrient content and nutrition label reading (Elbon et al., 2000). Variables, such as nutrition knowledge and level of education attained, all may interrelate. Those with a higher level of education may have had more exposure to nutrition information, which in turn could result in better healthful decisions, which could have a long-term, positive impact on nutritional risk level. Food
knowledge and support from social groups, family, and friends has been shown to be significant predictors of a healthful, varied diet (Dean et al., 2009; Duerr, 2003).

As age increased, so did the level of nutritional risk. The concept of ‘anorexia of aging’ encompasses physiological changes (hormonal, cytokines, changes in GI tract, decrease sensory), decrease energy expenditure, decrease physical activity, and pathological changes (medical, drugs, psychological, and social) (Ahmed & Haboubi, 2010) that would increase the level of nutritional risk among aging adults, as seen in this study. On the opposite spectrum, research also finds the majority of older adults to be obese (Ogden et al., 2006); the effects of overweight and obesity on chronic health conditions and mortality show a higher prevalence of frailty, low physical function, greater decline in physical function, and earlier onset of physical disability among older adults with high BMI, waist circumference, and percentage body fat (Villareal et al., 2004; Baumgartner et al., 2004; Houston et al., 2009). Therefore, it is important for older adults to be aware of their nutritional health risk and have adequate nutritional knowledge to know how to make healthful changes, and implement those positive, healthy changes into a lifestyle. A benefit of this study was the increased awareness of participants’ nutritional risk level.

Analyzing all the variables, nutritional risk level, age, and level of education attained, in regards to how it affects the nutrition knowledge score is very important; this information can be used to identify the most appropriate programs and lessons for the target population (Bandayrel & Wong, 2011). Even though this study showed nutrition knowledge score with no statistically significant results between nutritional risk level, age, and levels of education attained, there was a significant difference in the mean score.
of nutrition knowledge scores between the different nutritional risk levels. It was identified that variables such as poverty, education, inadequate food and nutrient intake, social isolation, urban/rural geographic area are manifold and often synergistic (ADA, 2000; "Current population: 1966-2008," 2008). The researcher concluded from the results that if nutrition education programs/lessons were given, then nutritional risk levels would potentially decrease (Patacca et al., 2004; Rainey & Cason, 2001). While conclusions regarding all variables together (nutritional risk level, level of education attained, and age) with nutrition knowledge cannot be made, this study does show significant findings for variables studied separately. These findings provide the rationale for further studies on the effect of Indiana Extension Homemakers Association membership on nutrition knowledge and nutritional risk level.
CHAPTER SIX

CONCLUSION

The purpose of this study was to examine the extent of nutrition knowledge of older women involved in the Indiana Extension Homemakers Association and compare this to the IEHA participants’ nutritional risk level, age, and level of education attained. This study determined if there was any relationship between nutrition knowledge and age subgroups of older adults. Also, age subgroups and nutritional risk levels were explored to determine any correlations with regard to differences in nutrition knowledge. In this final chapter, overall thoughts and conclusions, limitations, recommendations for future research, and recommendations for IEHA of Shelby County will be discussed.

Indiana Extension Homemakers Association has an extensive history. Founded in 1913, this organization is based on high morals and values that strengthen Indiana homes and families ("Indiana Extension Homemakers Association ", 2012). An important component to the organization is continuing education. Considering the potential that some information is learned by participating in nutrition education lessons that are offered, the researcher was interested in knowing more about the effectiveness of these lessons, especially within the context that many participants have been members for many years and have heard many nutrition lessons.
Questions that evolved during the course of this study included:

1. Have participants increased their nutrition knowledge as a result of the nutrition lessons? Is there evidence of increased nutrition knowledge?

2. Are participants applying that knowledge to making healthier decisions, resulting in lower nutritional risk level?

3. What other variables may affect nutrition knowledge?

Seventy-eight participants (85%) were in either the no/low- or moderate nutritional risk level category and scored above 80 percent on the nutritional knowledge questionnaire. The researcher concluded the majority of participants were knowledgeable and made use of this knowledge as evidenced by the higher nutrition knowledge score. It was also evident by lower DETERMINE Checklist score which reflects a positive relationship between nutrition knowledge and nutrition health status. Since participants are given opportunities to participate in nutrition education lessons at club meetings, it would benefit them to create an evaluation tool to assess current nutrition lessons to examine if their needs are met.

There is little to no research investigating on the Extension Homemakers Associations and nutrition education; therefore, further research is warranted.
Limitations

The research was limited in the following ways:

- The study was confined to the geographical area and specific group of the Indiana Extension Homemakers Association (IEHA) of Shelby County.

- Not all registered IEHA of Shelby County clubs participated in the study, therefore sample size was small (n=92). Recruitment took place at the IEHA of Shelby County Council meeting, in which all active clubs present agreed to participate. All clubs pay dues to the council, but do not actively attend meetings.  
  - Clubs not in attendance at the recruitment meeting could have been called, but were not considered active clubs (per IEHA of Shelby County president). If clubs were not actively attending meetings, then the researcher’s assumption that participants received nutrition education lessons as a result of being a part of IEHA and being an active member would have been incorrect.

- A convenience sample of individuals from IEHA of Shelby County was used; therefore the data reported may not be representative of all IEHA clubs.

- The group sizes for nutritional risk level were unequal in the no/low, moderate, and high nutritional groups, therefore harmonic mean of group sizes were used.

- All participants of this study were of white, non-Hispanic race/ethnic background and all participants had at least a 12th grade education level; 45% of all participants went to college/further training, obtained a bachelor’s degree, and/or master’s degree.
• This study relied on the 15-question, nutrition knowledge questionnaire to determine overall nutrition knowledge.

**Recommendations for Future Research**

Based on the results of this study, the following recommendations for future research are proposed:

• Create a pre-test, post-test study in order to gauge level of knowledge attained after the nutrition education lesson(s). This may answer questions regarding usefulness and effectiveness of current lessons/programs.

• Follow-up with participants to see if their increased awareness of their DETERMINE Checklist has caused/motivated them to make a healthful change.

• Further analyze each question of the DETERMINE Checklist to determine which areas of the checklist were particularly problematic within this population group. This analysis could further be used to identify what health behaviors could be emphasized in the nutrition education lessons.

• Expand the study to state-wide participation.

• Compare the outcomes of this population to other older Americans.

• Narrow the nutrition knowledge questions to a specific topic, preferably based on previous nutrition education lessons the club has been exposed to.

• Interview/survey participants on desired nutrition topics for nutrition education lessons, and/or add a survey to research the educational benefits of being a part of IEHA club.
• Keep surveys simple, to the point, and wording in large font. This is based on participants’ ability to see and understand directions, and participants’ ‘test taking’ skills.

• Conduct the surveys and questionnaires in person (not by email or phone) to develop rapport with participants to help increase compliance and completion.

**Recommendations for IEHA of Shelby County**

• Suggestive future topics for nutrition education lessons: vitamin B-12 (sources, benefits, signs/symptoms of a deficiency), cholesterol (differentiating between HDL and LDL), and/or nutritious ways to prepare food.

• Evaluate current nutrition education lessons and handouts.

• Conduct a pre – /post – nutritional risk assessment by having participants retake the DETERMINE Checklist survey to examine if the nutrition education lessons caused positive, health behavior changes leading to a lower nutritional risk score.

• Document, through surveys, the club members’ questions, thoughts, or concerns relating to the nutrition education lesson.

From this study, the researcher has made a contribution to the lack of research regarding the Extension Homemakers Association. Specifically, this research helps the Indiana Extension Homemakers Association of Shelby County clubs. From the results, clubs may better meet the needs of members by providing nutrition resources such as nutrition education lessons that are applicable and more relevant to members. These results can be used by other clubs and/or organizations with similar demographics. This
research can also be repeated so that it better tailors to the clubs’ and/or organizations’ needs.
REFERENCES


APPENDIX A

Institutional Review Board Documents
APPENDIX A-1

Letter from Ball State University IRB
Institutional Review Board

DATE: October 31, 2011

TO: Megan Allen

FROM: Ball State University IRB

RE: IRB protocol # 270624-2


SUBMISSION TYPE: Amendment/Modification

ACTION: DETERMINATION OF EXEMPT STATUS

DECISION DATE: October 31, 2011

The Institutional Review Board reviewed your protocol on October 31, 2011 and has determined the procedures you have proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol, and you are cleared to proceed with the procedures outlined in your protocol. As an exempt study, there is no requirement for continuing review. Your protocol will remain on file with the IRB as a matter of record.

Editorial notes:

1. Requested modifications (changes to survey) are approved.
2. Requested modifications do not alter the review level. Protocol remains Exempt.

While your project does not require continuing review, it is the responsibility of the P.I. (and, if applicable, faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project. Please contact Chris Mangelli at (765) 285-5070 or cmangelli@bsu.edu if you are unsure whether your proposed modification requires review or have any questions. Proposed modifications should be addressed in writing and submitted electronically to the IRB (http://www.bsu.edu/irb) for review. Please reference the above IRB protocol number in any communication to the IRB regarding this project.

Reminder: Even though your study is exempt from the relevant federal regulations of the Common Rule (45 CFR 46, subpart A), you and your research team are not exempt from ethical research practices and should therefore employ all protections for your participants and their data which are appropriate to your project.
APPENDIX A-2

CITI Collaborative Institutional Training Initiative
Completion Certificate
Social & Behavioral Research - Basic/Refresher Curriculum Completion Report
Printed on 9/13/2010

Learner: Megan Allen (username: meallen37)
Institution: Ball State University
Contact Information: Department: Family Consumer Science
Email: meallen@bsu.edu

Social & Behavioral Research - Basic/Refresher: Choose this group to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.

Stage 1. Basic Course Passed on 09/09/10 (Ref # 4906199)

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For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.  
Professor, University of Miami  
Director Office of Research Education  
CITI Course Coordinator
APPENDIX B

Letter of Permission
To: Megan Allen  
Re: Shelby County Extension Homemakers and Dietetics Research Project  
September 26, 2011

You have permission to present your dietetics research project to the Shelby County Extension Homemakers Council on October 5, 2011. You also have permission to utilize a survey instrument with the club members as a part of the research project.

If I can be of additional assistance, please don’t hesitate to call me at Purdue Extension-Shelby County; 317-392-6460.

Sincerely,

Diana L. Stone  
Purdue Extension-Shelby County  
County Extension Director  
Health & Human Sciences Educator
APPENDIX C

Letter of Information to Shelby County Extension Homemakers
October 2011

Dear Shelby County Extension Homemaker,

I, Megan Allen, am researching the perspectives of Indiana Extension Homemakers of Shelby County in regards to assessing nutrition education and nutritional risk level among older women. The title of my research study is, “Assessing Nutrition Knowledge and Nutritional Risk Level of Older Women in Extension Homemakers Association”. I would sincerely appreciate it if you would assist me in this research. This research could not only help assess the effectiveness of IEHA nutrition education programs, but also help provide the necessary tools and information to other organizations to help evaluate new or existing nutrition programs.

The DETERMINE Your Nutritional Risk Checklist is a quick and simple, nationally used survey to help determine your nutritional risk. I have also asked a few, simple demographic questions at the bottom. The nutrition knowledge questionnaire is around 10 questions that are based on the 2010 Dietary Guidelines for Americans and questions used in previous studies. All data collected will be confidential and all responses to the survey/questionnaire are anonymous. Only myself, the researcher, and my thesis committee will have access to the data which will be stored in a locked file cabinet and destroyed after three years. Your participation is voluntary, and you may withdraw from the study at any time, for any reason without penalty.

If you agree to participate, you will be asked to complete the DETERMINE Checklist with demographic survey and the nutrition knowledge questionnaire. There are no known physical, psychological, legal, social, economic, or other risks associated with participation in this research project. There are no costs to you or any other party.

This project has been reviewed according to Ball State University’s procedures governing participation in this research. If you have any questions, concerns, or complaints about any part of this study, you may contact me or my faculty thesis supervisor.

Megan E. Allen, Graduate Student
Dept. of Family and Consumer Sciences
Ball State University
Muncie, IN 47306
Phone: (317) 512-3890
Email: meallen@bsu.edu

Faculty Thesis Supervisor:
Dr. Alice Spangler
Dept. of Family and Consumer Sciences
Ball State University
Muncie, IN 47306
Phone: (765) 285-5931
Email: aspangle@bsu.edu
For questions about your rights as a research participant, please contact:

Office of Research Integrity  
Ball State University  
Muncie, IN 47306  
(765) 285-5070  
irb@bsu.edu

You may also contact the Ball State University’s Office of Academic Research and Sponsored Programs at (765) 285-1600 or at http://cms.bsu.edu/About/AdministrativeOffices/SPO.aspx if you have any questions or comments regarding your rights as a participant in this research.

Thank you so much for your participation in this study.  
Sincerely,  

Megan Allen  
Dietetic Graduate Student  
Department of Family and Consumer Science
APPENDIX D

DETERMINE Checklist & Demographic Survey
Are you a member of the Indiana Extension Homemakers Association (Shelby County)?

☐ YES  ☐ NO

What year were you born in? ________________________________.

What is the highest grade in school completed?

☐ 1  ☐ 2  ☐ 3  ☐ 4  ☐ 5  ☐ 6  ☐ 7  ☐ 8  ☐ 9  ☐ 10  ☐ 11  ☐ 12

☐ 13  ☐ 14  ☐ 15  ☐ 16 (graduated college: BS/BA)  ☐ 16+

What is your race or ethnic background(s)? check all that apply

☐ White  ☐ Black or African American

☐ American Indian or Alaskan Native  ☐ Asian

☐ Native Hawaiian or Pacific Islander  ☐ Other

Are you Hispanic/Latino American?

☐ Yes  ☐ No
APPENDIX E

Nutrition Knowledge Questionnaire
Nutrition Knowledge Questionnaire

The study is voluntary and subjects are free to discontinue participation at any time without prejudice from the researcher. This study has no bearing with your participation with the Indiana Extension Homemakers Association of Shelby County.

**DO NOT** put your name on the survey or questionnaire. The results of your survey and questionnaire will be kept anonymous. Only group data will be reported.

We request that you do not share answers with others and answer the questions honestly and to your best ability. If you have any questions concerning the survey or questionnaire please direct them to the researcher or person administering them.

Thank you very much for your participation!!!

1. Older adults (60yr +) need _______________________________________.
   a. MORE calories than a younger adult (18-59 years old)
   b. **FEWER calories than a younger adult (18-59 years old)**
   c. the SAME amount of calories as a younger adults (18-59 years old)

2. Which type of milk has the fewest calories per serving (1 cup)?
   a. 2% milk
   b. 1% milk
   c. Whole milk
   d. **Skim milk**

3. What vitamin helps the body absorb calcium?
   a. Vitamin A
   b. Vitamin C
   c. **Vitamin D**
   d. Vitamin E

4. Which of the following is most likely the BEST source of dietary fiber?
   a. Brown bread
   b. White bread
   c. **Whole grain bread**
   d. White yeast rolls

5. Which of the following can increase blood pressure?
   a. Too much sodium (salt)
   b. Being overweight or obese
   c. **Both A & B**
   d. Eating foods high in dietary fiber
6. Which of the following is a good source of vitamin B-12?
   a. **Beef**
   b. Broccoli
   c. Milk
   d. Strawberries

7. Which of the following is healthiest for cooking?
   a. Shortening
   b. Butter
   c. Margarine
   d. **Canola oil**

8. What do health experts call “good” cholesterol?
   a. LDL
   b. Trans- fats
   c. **HDL**
   d. Saturated fats

9. Which one of following is a starchy food?
   a. **Corn**
   b. Green beans
   c. Lettuce
   d. Mushrooms

10. To help prevent chronic diseases, it is recommended that you engage in physical activity for _______ minutes on most days of the week.
    a. 15
    b. 60
    c. **30**
    d. 90

11. Which of the following foods is a good source of iron?
    a. Egg whites
    b. **Dried beans**
    c. Milk and milk products
    d. Carrots

12. Vegetable skin and pulp provides _________ to help with digestion and help keep you ‘regular’?
    a. Antioxidants
    b. B vitamins
    c. Minerals
    d. **Fiber**
13. What is the least nutritious way to prepare green beans?
   a. Boiling on top of stove for 45 minutes
   b. Boiling on top of stove for 20 minutes
   c. Boiling on top of stove for 10 minutes
   d. Cooking in a microwave oven cooking for 10 minutes

14. Which of the following statements below is INCORRECT?
   a. Older people are at risk for dehydration.
   b. Fruit can help contribute to overall fluid/hydration intake.
   c. A symptom of dehydration is constipation.
   d. A person needs to hydrate (or drink water) only if she feels thirsty.

15. Which of the following is an example of a sugar substitute?
   a. Cane sugar
   b. Splenda®
   c. Brown sugar
   d. Powder sugar