The Effect of Live versus Recorded Music during Mealtimes on the Nutritional Intake of Older Adults in an Assisted Living Facility

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THE EFFECT OF LIVE VERSUS RECORDED MUSIC DURING MEALTIMES ON THE NUTRITIONAL INTAKE OF OLDER ADULTS IN AN ASSISTED LIVING FACILITY

By

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This thesis is dedicated to the beautiful residents of the assisted living facilities in Jacksonville, Florida. My hope is that your experience in this study is one step towards improving your health and happiness, and that you live the rest of your life with unrestrained joy.
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ABSTRACT

The purpose of this study was to examine the effect of live versus recorded music on the nutritional intake of older adults during mealtimes in an assisted living facility. Nutritional health is an important component of maintaining quality-of-life. Poor nutrition in older adults is due to health conditions, life changes, and other symptoms of aging. Attention to proper nutrition is too often neglected or absent in the lives of many older adults, especially those in long-term care. Interventions exist to combat malnutrition and its consequences, including sensory stimulation interventions involving recorded music; however, no research has been done examining the impact of live music therapy, which is extensively regarded as more effective than recorded music in other contexts.

Participants in this study were residents at two assisted living facilities. The design of the study was ABAC or ACAB, where A was the no-music control, B was recorded music, and C was live music therapy. Food intake was measured using a plate-waste survey. Results indicated that food intake increased with both recorded music and live music; however, a significant increase in food intake was found between the no music and live music conditions. The increase in food intake between the no music and recorded music conditions was not significant. These results have implications for the role of music therapy in improving the food intake of older adults, and thus, their nutritional health as well.
CHAPTER ONE
INTRODUCTION

The world’s population is rapidly aging. Thanks to modern medicine, technological and scientific advances, and the high birth rates of the mid-1900s, people are living longer than ever. Problematically, growth of the young adult population hasn’t kept pace with that of the older generation. In the next 35 years, the US Census Bureau predicts that the population aged 65 and older will increase by 150 percent, whereas the younger, working-age population is expected to increase only by 25.6 percent (He, Goodkind, & Kowal, 2016). The older adult population will no longer constitute a minority, and reexamination of how they are treated is increasingly relevant. Developing new ways and means to improve the quality of an increasingly lengthening lifespan is in everyone’s best interest.

Nutrition and Older Adults

“Well-being” is a term for overall wellness, including physical health, emotional stability, and cognitive function, all of which are necessary for good quality-of-life. The most basic and important facet of well-being, including the well-being of older adults, is nutrition. Food is a behavioral, social, psychological, sensory, and physiological component of well-being that is no less important in old age than any other time in life (Amarantos, Martinez, & Dwyer, 2001). In particular, nutrition plays a substantial role in either managing or exacerbating the symptoms associated with aging.

As people age, body systems lose full function and become less efficient. Metabolic rates and appetite decrease, while mobility and dentition are often impaired
(Scarlatta, 2015). Challenges that older adults frequently encounter include: social isolation, depression, dementia, medications with adverse side-effects, and chronic illnesses (Chapman, 2012). These factors impact food intake, which often decreases when seniors feel unwell. Reduced food intake puts older adults at risk of involuntary weight-loss and malnutrition (Staveren & de Groot, 2012). A vicious cycle ensues: pre-existing conditions reduce appetite, and poor nutrition worsens the pre-existing conditions.

Reduced food intake and weight-loss have a significant impact on health and function of older adults. Many so called “killers” that are associated with old age are actually due, or aggravated by, involuntary weight-loss; Alzheimer’s disease, kidney disease, osteoporosis and fractures, sarcopenia and cachexia (loss or atrophy of skeletal muscle mass), dehydration, weakness, and hyperhomocysteinaemia (a risk factor for cardiovascular disease), are just a few common health complications associated with weight-loss (Chapman, 2012), (Staveren, & de Groot, 2012).

**Nutrition in Long-Term Care**

Seniors living in long-term care, a setting that encompasses assisted living or skilled nursing facilities, home-health services, hospices, and adult day centers, are a particularly high-risk group for malnutrition. The percentage of residents living in long-term care is increasing with the growth of the older-adult population. In 2007 an estimated 13 million Americans aged 65 years and older were receiving long-term care services, and in 2050 that number is projected to more than double to 27 million Americans (Centers for Disease Control and Prevention, 2013).
Thomas (2012), found that loss of 10% or more of body weight can put an independent elderly individual at a 60% increased mortality rate. In long-term care, loss of 10% or more of body weight predicted death within the next 6 months, and loss of 5% or more of body weight made the individual 4.6 times more likely to die in one year compared to weight-stable individuals. Dyck (2013) found that between 35%-85% of nursing home patients lose weight as a result of malnutrition. These data clearly indicate that malnutrition is a too-common health-risk that is diminishing the quality-of-life for adults in long-term care.

*Nutrition-Enhancement in Long-Term Care.* Some interventions are currently in use to prevent or halt weight-loss. The dining room environment is often manipulated to enhance sensory experience. Using high-contrast tableware, specially designed lighting, fish-tanks with brightly colored fish, bright wall art, decreasing people-generated noise, and playing background music are all ways that have been implemented to maximize a pleasant-dining-ambiance (Jackson, Currie, Graham, & Robb, 2011). Dyck and Schumacker (2013) also found that increasing the amount of direct care-time from caregivers was correlated with a 17% decrease in weight-loss and dehydration in residents, compared to residents who did not receive increased direct care-time, indicating that social interventions have an impact on preventing weight-loss. Additionally, when professional care from registered dieticians and speech therapists was given to provide feeding assistance, treatment of dysphagia, or treatment of other feeding disorders, weight-loss also decreased (Pearson, Wiechula, Court, & Lockwood, 2011).
The Impact of Music on Nutrition in Long-Term Care. Some research has been done on the effect of background music on the nutrition of older adults during mealtimes. Vucea, Keller, and Ducak, (2014) conducted a meta-analysis of mealtime interventions including eight studies that examined the use of background music. Of those studies, Thomas and Smith (2009), and Richeson and Niell (2004), studied the impact of background music on nutritional intake. In both studies, nutritional intake increased when recorded music was played in the background during mealtimes, and caloric intake often increased by 20%. Likewise, Thomas and Smith (2009) found that residents remained in the dining hall longer and were more socially engaged when recorded music was played.

The effect of music therapy (including mostly live interventions) has been extensively documented in research treating a multitude of conditions in older adults, and much of the research shows that live music has a greater impact than recorded music on treating certain conditions (Bailey, 1983; Baker, 2001; Segall & Darrow, 2007). The human element of music therapy may play an important role in treatment; however, to date, there has been no research studying the effect of live music on nutritional intake of older adults during mealtimes.

Rationale and Purpose of Study

Addressing quality-of-life issues in older adults is increasingly relevant in modern society as the percentage of older adults grow. Medical research indicates that malnutrition and weight-loss put seniors at a high risk of developing adverse health conditions or even premature death. These concerns are especially relevant for older adults in long-term care. Research on the treatment of malnutrition in older adults still
requires growth to address the health and quality-of-life concerns for older adults. Studies show that environmental enhancement, such as lighting or recorded music, can have a positive impact on nutritional intake. Social interventions, such as increasing direct care-time or professional assistance, appear to help as well. The effectiveness of music therapy in comparison to recorded music has been attributed to its added human component. Together with music’s inherent sensory-enhancing qualities, music therapy’s socially stimulating aspects may create a uniquely effective treatment for malnutrition. The purpose of this study is to examine the effectiveness of music therapy versus recorded music during mealtimes on the nutritional intake of older adults in an assisted living facility.
CHAPTER TWO

REVIEW OF LITERATURE

The areas discussed in this chapter are: nutrition needs of older adults, challenges older adults face in achieving ideal nutrition, the impact and consequences of inadequate nutrition, and current interventions designed to prevent malnutrition. Live music, including music therapy, has been widely documented in literature as being more effective than recorded music in meeting many behavioral or physiological objectives, but no literature exists investigating the effects of live music during mealtimes on nutritional intake of older adults. The following review of literature will outline and describe the rationale for this study.

Nutrition and Hydration Needs of Older Adults

*Hydration.* Older adults have specific nutrition and hydration needs. Hydration is a part of total well-being that often receives insufficient attention. With age, the sensory capabilities that signal hunger and thirst can become impaired, and loss of independence requires the creation of a new day-to-day routine. The loss of natural "signals" to hydrate (feeling thirsty, or drinking at routine times), make it easy for older adults to become dehydrated without recognizing it (Keller, 2010).

Dehydration can also occur as a side effect of many common medications and diuretics (Thomas, 2012). In long-term care, staff must be especially watchful for signs of dehydration in residents who forget or do not recognize that they are thirsty. Dehydration can be mistaken for other symptoms associated with aging, such as confusion, weakness, skin problems, or fatigue. Misinterpreted symptoms often lead to incorrect diagnosis and inappropriate treatment that doesn’t address the problem of
dehydration (Keller, 2010). Acute weight-loss (weight-loss that occurs very rapidly) is almost always in response to dehydration (Thomas, 2012).

**Vitamins and Minerals.** Certain vitamins and minerals are important for maintaining strength and function during the aging process. Bonjour, Gueguen, Palacious, Shearer, and Weaver (2009) observed that even in healthy adults, bone mass decreases with age and can often cause postural instability, frailty, and falls with fractures. They recommend that seniors regularly supplement their diet with vitamins to support bone-health and function, including calcium, and vitamin D. B vitamins, including B$_2$, B$_6$, folate, and B$_{12}$, are important for cardiovascular health, and B vitamin deficiency increases the risk of developing a heart condition (Bonjour, Gueguen, Palacious, Shearer & Weaver, 2009).

**Macronutrients.** Macronutrients that are needed for bodily function include protein, fats, and carbohydrates. These three building blocks for survival cannot be created by the body, and macronutrient needs change with age (Young, 1992). Carbohydrates are responsible for providing energy and regulating blood sugar, and eating complex carbohydrates is recommended to prevent fatigue and to stabilize blood sugar in older adults. Mobility decreases and muscle tissue begins to atrophy with age, so an increase in protein intake has been indicated to prevent muscle loss. Similarly, fats are a very important part of a healthy diet for seniors, with nutrition experts recommending that almost half of all caloric intake should come from fats (Paddon-Jones & Rasmussen, 2009).

Despite ensuring that the quality of food being offered to seniors is tailored to their nutritional needs, with the optimal balance of vitamins, minerals, and
macronutrients, seniors can still be at risk for weight-loss. The true culprit responsible for malnutrition is often not quality, but the quantity of food consumed (Staveren & de Groot, 2012). Food intake is often simply not sufficient to sustain wellness. Staveren and de Groot (2012) further emphasize that this problem is particularly present in the “institutionalized elderly,” or older adults in long-term care. Regardless of whether the item of food is a pizza or salad, it appears that what matters most is that it is eaten.

**Challenges to Achieving Ideal Nutrition**

*Cooking.* For adults attempting to maintain independence by preparing food in their homes, cooking presents some new challenges. According to the American Burn Association (ABA), the physical changes of aging and the amount of poverty present in the older population contribute to an increased risk for house fires. The ABA specifically emphasizes diminished sensory perception and impaired mobility as factors that make the elderly particularly vulnerable to cooking fires. Diminished visual, auditory, smell, and tactile perception can contribute to a senior failing to see a burner or oven that is left on, hear sounds like smoke alarms or the running of a microwave, smell burning food or smoke, and feeling that a surface is warm or growing hot before fire breaks out. Additionally, challenges in navigating the kitchen with impaired mobility can result in cooking mistakes or accidents, and prevent older adults from being able to escape a fire.

According to the ABA, older adults between the ages of 65 and 75 have twice the fire death rate when compared to the national average. Those between the ages of 75 and 85 have three times the death rate, and those older than 85 are at four-fold risk of having a fire-related death when compared to the national average. Fires and burns are
the leading cause of accidental death in older adults, and cooking fires are the leading cause of injuries involving fires (FA-203, 1999). Community Fire and Burn Prevention Programs have lists and protocols that older adults can follow to maintain safety while cooking in the home. These protocols include handling of hot food, hot pans, pots, or dishes, use of appliances, and proper clothing to wear when cooking.

The ABA acknowledges how discouraging these dangers can be to older adults who consider cooking a pleasant and important part of daily life. Cooking, sometimes seen as a mark of remaining independence, is one of the hardest relinquished activities for those who need some level of long-term care. Seniors often spend decades of their lives cooking for themselves, family, friends, or their community. Rather than resorting to ready-made meals or risking injury while cooking, it is possible seniors may simply eat less.

*Eating Alone.* Eating meals is a social activity where friends and family can gather to talk and enjoy one-another’s company. When socialization is no longer a component of eating, proper nutrition is often compromised (Holt-Lunstad, Smith, & Layton). Social isolation is a problem for about half of older adults aged 75 or over who live alone, especially those who live alone after the death of a spouse or partner (Conklin, 2013). According to meta-analytic research conducted by Holt-Lunstad, Smith, and Layton (2010) and cited by the Campaign to End Loneliness (2011), loneliness (lack of social connections and relationships) is as dangerous to health as smoking 15 cigarettes a day. Nutrition is a key player in this health deficit; diet variety, routine, quality, and quantity can be impacted and compromised as a result of social isolation.
Sensory Loss. As the body ages, sensory organs, precision, and capability can become impaired. All the senses, including smell and taste, lose key characteristics over time. Smell can be the first sense to change, even as early as middle-adulthood, and can become severely impaired in later life (Schmall, 1991). The sense of smell is important for nutritional health because smell is responsible for two thirds of taste sensation. Smell helps us identify foods, whether they are preferred, whether they are stale or fresh, or whether they are raw or cooked. Smell is also intricately bound to emotion. While the precise mechanisms are not fully understood, Fields (2012) cites research indicating that the olfactory bulb (the organ responsible for processing smell), has unique connections to both the amygdala (the emotion center in the brain), and the hippocampus (the memory center in the brain). Smell is an important part of the eating experience that has roots right into where people think, feel, and remember. It makes sense that as this important sense begins to dwindle with age, so does appetite (Schmall, 1991).

Taste itself is also impaired with age. The number of taste buds present on the tongue decrease with age (Schmall, 1991), limiting the range of tastes that can be experienced. Dietary restrictions can also impact taste – diets that are textured, low in sodium, or low in sugar can make food taste bland. Changes in smell and taste impact the enjoyment that is experienced with eating. Eating may lose much of its pleasure once it no longer tastes like it used to, no longer smells pleasurable, and has less emotional meaning and history. Pleasure has been already indicated as a major motivating factor in eating behavior, so it is possible that a decrease in pleasure can easily lead to a decrease in food intake, putting an older adult at risk for malnutrition.
**Changes in Digestion.** Though the digestive system is remarkably resilient as the body ages and maintains the overall nutrient absorption and waste elimination functions, there are certain changes with age that impact the gastrointestinal tract and may lead to decrease in appetite. In an article describing the impact of age on digestion, Scarlatta (2015) observes that as muscle atrophy tends to occur in other organ systems, muscle tone tends to decrease in the digestive system as well. Without the ideal strength to move food through the digestive tract, constipation can become a problem, which in turn, can lead to the development of hemorrhoids. Muscle weakening impacts the upper gastrointestinal system as well, leading to disruption in the flow of food down the esophagus. A health condition common among seniors and aggravated by this disruption in normal flow is Gastroesophageal Reflux Disease (GERD), which can make eating painful.

In addition, almost two thirds of adults over the age of 80 have a common digestive condition called diverticulosis, which impacts the function of the large intestine. Symptoms of diverticulosis include constipation, diarrhea, and abdominal pain. Older adults with GERD or diverticulosis may feel like eating is a no-win game. It is no surprise that having these health conditions might lead to a decrease in appetite and inadequate nutrition (Scarlata, 2015).

Salivation also tends to diminish with age. Digestion actually begins in the mouth before food is even swallowed, and saliva plays a large role in food breakdown and stimulating the swallow reflex. Having “dry mouth” (inadequate saliva) can lead to dysphagia and other swallowing or feeding difficulties that must be remedied with therapy or other medical intervention. Saliva is also an important part of dental health.
As the protective “shield” of saliva thins over the surface of the teeth, dentition and enamel erosion increase and teeth are lost, making eating uncomfortable and difficult. Eating can quickly become a chore rather than a pleasure when food must be textured, painstakingly chewed, and difficult to swallow (Scarlata, 2015).

Changes in Mood. Though it is a common misconception that depression increases with age (Scheibe & Carstensen, 2010), mood disorders, especially depression and anxiety, occur in older adults as frequently as they do in the general population. Additionally, depression is associated with, or a symptom of, health conditions that appear in old age, such as Parkinson’s Disease, Alzheimer’s Disease, dementias, and stroke (Sadovsky, 1998). Suicide is tragically common, especially among older white males, for whom the suicide rate is six times the national average (American Foundation for Suicide Prevention, 2016).

Mood can impact the appetite of an older adult experiencing depression or anxiety; appetite change is one of the common symptoms of depression, and might involve a decreased appetite in addition to weight loss (American Psychiatric Association, 2013). Seniors who are experiencing a health condition that compounds the effects of a depressed mood, may be at additional risk. In all cases where mood alteration occurs (like depression or anxiety) food intake may be impacted, leading to malnutrition.

Poverty. Poverty and risk of hunger in older adults is a concern that often goes unnoticed. According to the Social Security Administration, 22% of married social security recipients 65 years of age and older, and nearly half of unmarried social security recipients 65 years of age and older, rely on social security for 90% or more of
their income. The average Supplemental Security Income for an older adult is reported by the Social Security Administration to be $433 a month, which is often not enough to provide for basic needs. Almost a third of older adults find themselves in debt or with nothing left after paying essential expenses each month.

According to an annual report by Ziliak and Gunderson (2015) compiled using a 2013 Current Population Survey (CPS), and sponsored by the National Foundation to End Senior Hunger, 15.5% or 9.6 million older adults (aged 60 years or older) face food insecurity as a result of poverty. Though these citizens are eligible for the Supplemental Nutrition Assistance Program (formerly known as Food Stamps), few older adults are aware this resource exists. Less than half of eligible senior citizens are enrolled in the program, leaving many seniors in America without the resources they need to feed themselves. Poverty compounds the challenges seniors face in managing their nutrition; even in perfect health, sometimes older adults do not eat enough because they have no food.

**Medications.** An increase in common health conditions can occur with age, and many seniors experience health issues like high blood pressure, high cholesterol, depression, diabetes, and joint pain. Older adults often take multiple medications to manage the symptoms they experience. An article by Ruscin and Linnebur (2014), published for Merck Manual, describes common problems associated with drug-related effects. Ruscin and Linnebur (2014) describe the risks of prescription drug-use in a vulnerable population, risks that may result in older adults experiencing adverse effects. Side effects of medications can be uncomfortable and include nausea, vomiting, dry-
mouth, or reduced appetite. All these can make eating unpleasant and lead to reduced food intake.

Ruscin and Linnebur (2014) further note that necessary medication is sometimes under-prescribed by physicians who are concerned about the side-effects on their elderly patients. This level of concern may backfire if a patient is not receiving an appropriate dose of essential medication. The health condition could worsen, or symptoms like pain, nausea, and fatigue could remain unresolved. Confusion or miscommunication between the doctor and the patient can also result in poor compliance or adherence to treatment regimens. It is possible that appetite and nutrition would be compromised if symptoms related to health conditions were not well-managed.

Over-prescribed medications also lead to drug-related problems. Older adults are sometimes more sensitive to the effects of certain medications, and often require smaller doses than would be appropriate for younger adults. Additionally, because older adults are frequently on more than one medication, a situation called polypharmacy, interactions between the medications commonly occur. Polypharmacy can result in adverse side-effects or even the development of another health problem (Ruscin & Linnebur, 2014).

Older adults also can face more than one health condition at the same time. Ruscin and Linnebur (2014) describe a crossover reaction that can occur: drugs designed to treat one condition can adversely effect other co-occurring diseases. Many variables and potential risks make caring for the elderly with medication complex and potentially dangerous. In the context of nutrition, any adverse effects, side-effects, or
worsening of conditions could lead to reduced appetite, food intake, and malnutrition (Ruscín & Linnebur, 2014).  

**The Impact and Consequences of Inadequate Nutrition**

In recent decades, the hot-button issue in nutrition has been the danger of being overweight and eating too much. The multi-billion dollar diet industry is devoted to weight-loss in response to the “obesity epidemic” in modern society. An independent market research firm, Marketdata Industries, Inc., estimated in their 2011 report that the weight-loss market generates over 60 billion dollars in revenue each year. Caloric restriction is extremely popular and touted as the solution to major health issues such as obesity, heart disease, diabetes, and others; however, studies examining the impact of long-term caloric restriction and reduced food intake in older adults have warned against unforeseen consequences, and have labeled such practices as potentially dangerous (Morley, Chahla, & Alkaade, 2010).

Weight-loss is especially contraindicated, and impacts middle-aged adults as well as seniors. Thomas (2005) discovered that a loss of 10% or more of body weight between those aged 50 and over is associated with a 60% increase in mortality compared with weight-stable adults. More troubling, for community-dwelling seniors, weight loss of 4% was found to be an independent predictor of increased mortality. For older males living at home, weight loss is correlated with a 76% increase in mortality rate (Payette, Coulombe, Boutier, & Gray-Donald, 1999).

Weight-loss in long-term care facilities is even more dangerous. Ryan, Bryant, Eleazar, Rhodes, and Guest (1995) found if a resident lost 10% of their body weight over the course of 6 months, it predicted their death in the following 6 months.
Residents who lose 5% of their body weight in any given month are found to be at a 10-fold greater risk of death (Sullivan, Johnson, Bopp, & Roberson, 2004). For example, if an individual weighs 130 pounds, loss of 13 pounds (10%) is enough to predict their death within 6 months. Even residents who lose weight through intentional dieting put themselves at a higher mortality risk than their weight-stable or weight-gaining counterparts. Statistics such as these clearly indicate that weight-loss in seniors, especially seniors in long-term care, is dangerous for their health.

Weight can be lost in a number of ways: starvation, sarcopenia, anorexia, and/or cachexia. Starvation occurs when the body does not receive adequate calories to maintain total function. As muscles atrophy and bones thin with aging, weight can be lost through thinning tissues in a process known as sarcopenia. Anorexia refers to inadequate appetite, or lack of appetite. Cachexia is weight-loss that occurs as a result of a disease process. Cachexia is common in chronic illnesses such as cancer, HIV/AIDS, dementias, and Parkinson’s disease. Medical treatment for involuntary weight-loss is prescribed by triaging symptoms and pinpointing why the weight-loss is occurring (Thomas, 2007). Properly categorizing weight-loss as a result of starvation, sarcopenia, anorexia, or cachexia can lead to appropriate diagnosis and treatment.

**Interventions to Prevent Malnutrition**

*Medical Interventions.* Starvation (inadequate caloric intake) is often treated by enteral feeding (tube-feeding). Enteral feeding is used in many acute situations where immediate caloric intake is necessary for survival. It is also used in situations where the individual either has significant difficulty or inability to take food by mouth, often due to disease or disability. In cases of sarcopenia, strength-training exercises are used to
reinforce bone-support and stimulate muscle growth. Dietary enhancements for sarcopenia include adequate protein and fat intake to restore lost muscle mass.

Anorexia and cachexia often occur together. Loss of appetite (anorexia) is a common side-effect of chronic diseases that may cause cachexia. Pharmacological interventions for anorexic and cachexic weight loss often involve orexigenic medications, cannabinoids, or steroids, all used to increase appetite. Unfortunately, medication is only marginally effective for treatment of cachexia, and weight restoration usually only occurs after the chronic illness is resolved (Gordon, Green, & Goggin, 2005).

**Behavioral Interventions.** Many behavioral interventions are designed to enhance the dining environment, and involve many modes of sensory stimulation to create a pleasant ambiance. A meta-analysis performed by the Joanna Briggs Institute (2011), investigated four studies that manipulated the table setting environment. In these studies, normal tableware was replaced with “high-contrast” tableware such as brightly colored red and blue cups and plates. This study showed a significant increase in food and fluid intake. Similar studies by Dunne, Neargarder, Cipolloni, and Cronin-Golomb (2004), and Brush, Meehan, and Calkins (2002) also found that colorful tableware enhanced food and liquid intake. Research also indicates that lighting can create a stimulative contrast. Dining areas that were specially lighted tended to produce the same trend of increased food intake as the high-contrast tableware interventions (Koss & Gilmore, 1998; McDaniel, Hunt, Hackes, & Pope, 2001; Dyke & Schumacker, 2013).

The presence of aquariums with brightly colored fish in dining areas is another intervention used for sensory stimulation (Edwards & Beck, 2013). The second study in
the Joanna Briggs Meta-analysis indicated a 21.1% increase in weighed food intake when dining halls installed aquariums. Mamhidir, Karlsson, Norberg, and Mona (2007) found that personalizing the dining hall with intimate character made a difference in nutritional intake. Making the room look comfortable by hanging pictures on the walls, dressing up the room with attractive curtains and tablecloths, or even placing personal items belonging to the individuals in the room, was correlated with an increase in food intake. Desai, Winter, Young, and Greenwood (2007), similarly found that changing the environment to be more home-like and intimate encouraged seniors in long-term care to eat more.

Staff education and providing feeding assistance for seniors experiencing dysphagia or other feeding disorders improves nutrition. According to a study by Dyke (2007), residents who received 3 hours or more of patient care a day experienced a 17% decrease in weight-loss and dehydration. Increased time spent with registered nurses had a similar significant effect (Horn, Buerhaus, Bergstrom, & Smote, 2005). The presence of a patient-caregiver to cue and prompt feeding also helps, but requires the presence of dining assistants or volunteers (Simmons, Keeler, Zhuo, Hickey, Sato & Schnelle, 2008). Professional care at the hands of speech or occupational therapists and dietitians has been shown to encourage better food intake as well (Vogelsmeier & Scott-Cawiezell, 2011).

Finally, providing auditory stimulation with recorded music also has a positive impact on food intake. The fourth study of the Joanna-Briggs Institute meta-analysis (2011) examined the impact of background music on nutritional intake. The study had mixed results, but indicated that on days when background music was played, caloric
intake increased by 129kcal. Vucea, Keller and Ducak (2014) conducted a meta-analysis of mealtime interventions, including eight studies that examined the use of background music. Of those studies, Thomas and Smith (2009) and Richeson and Neill (2004) examined the impact of recorded, background music on nutritional intake. Thomas and Smith (2009) found that with background music, total caloric intake increased by 20%; Richeson and Neill (2004) observed a total intake increase of 8.6%.

Three things should be noted about the studies involving recorded music included in this review: first, the population that was being studied involved older adults with dementia or Alzheimer’s disease. The reason these studies have been included is because malnutrition in older adults is not a condition that is unique to dementias or Alzheimer’s disease, but a symptom of physical conditions common to seniors with and without cognitive impairment. Second, in all of the studies, the music was recorded and played as background or “white noise” to mask distracting sounds and reduce agitation.

Third, most of the studies were very general in how music was chosen for the study, and did not necessarily take patient-preference or therapeutic effectiveness into account. Ragneskog, Brane, Karlsson and Kihlgren (1996) and Wong, Burford, Wyles, Mundy, and Sainsbury (2008) described their music choice as “soothing” while McDaniel, Hunt, Hackes and Pope, (2001) described their choice as “relaxing”, indicating that the music chosen was generally pleasant, but that it wasn’t necessarily preferred or chosen by the participants. Only one study conducted by McHugh, Gardstrom, Hiller, Brewer, and Diestelkamp (2012) examined the effect of live singing before meals on the nutritional intake, but the results were inconclusive.
**Rationale and Research Questions**

There are many interventions that exist to prevent or reverse malnutrition in the elderly, some of the most effective being behavioral rather than medical or pharmaceutical. Among these interventions, two of the most successful are environmental enhancement interventions, and interactive, care-based interventions involving nurses, caregivers, therapists, and aids. Music therapy is a practice that uniquely blends sensory stimulation through music, and an interactive component through therapy, positioning it as a potentially powerful tool to fight malnutrition. The research questions addressed in the study were:

1. What is the effect of live music during mealtimes on the nutritional intake of older adults in an assisted living facility?

2. What is the effect of live versus recorded music during mealtimes on the nutritional intake of older adults in an assisted living facility?
CHAPTER THREE

METHOD

Participants

Participants were recruited from two separate assisted living facilities that were of similar size and demographic, that also held daily meals in a dining hall ($N = 21$). Criteria for inclusion in the study were: older adults (65 years or older) with adequate auditory skills, ability to self-feed in a dining hall, and at risk of malnutrition. Approval was granted by nursing administrators who were interviewed regarding which residents might be appropriate for the study. “Malnutrition” of a potential subject was determined at the nursing administration’s discretion; however, residents were chosen based on the presence of nutritional risk factors including weight-loss, reduced food intake, recent or chronic illness, recent admission to the facility, or recent hospitalization.

Participants were recruited “door-to-door” within the facilities. The researcher verbally described the study and potential benefits and provided letters of consent to the residents interested in participating. Residents who signed the consent forms were offered copies to keep for their records, and were interviewed regarding their preferred music. The researcher noted which genres or songs were particularly meaningful for each participant. Consent forms were collected from 21 participants and 20 participants were present for the duration of the study.

Setting and Materials

Sessions were conducted during the noon and evening meals in the facility dining halls. An average of 3-5 residents were seated at each table, and study participants were interspersed among other residents who were not participating in the
Each resident was offered meal choices off of a menu, or could order dishes a la carte to their preference.

Table 1: Participants by Facility and Preferred Music

<table>
<thead>
<tr>
<th>Facility X</th>
<th>Participant</th>
<th>Sex</th>
<th>Music Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>F</td>
<td>Oldies, Classical</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>F</td>
<td>Jazz, Sinatra</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>M</td>
<td>Oldies, Country</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>F</td>
<td>Oldies</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>F</td>
<td>Oldies</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>F</td>
<td>Oldies</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>M</td>
<td>Country/Western</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>F</td>
<td>Showtunes/Sinatra</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>M</td>
<td>Oldies, Hymns</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>M</td>
<td>Oldies, Jazz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility Y</th>
<th>Participant</th>
<th>Sex</th>
<th>Music Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>11</td>
<td>F</td>
<td>Showtunes, Oldies</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>F</td>
<td>Hymns, Country, Oldies</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>F</td>
<td>Oldies</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>F</td>
<td>Oldies</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>M</td>
<td>Classical, Jazz</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>F</td>
<td>Oldies</td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>F</td>
<td>Classical, Jazz, Oldies</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>F</td>
<td>Gospel, Tennessee Ernie Ford</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>F</td>
<td>Contemporary Christian, &quot;At the Cross&quot; by Chris Tomlin</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>F</td>
<td>Showtunes, Oldies</td>
</tr>
</tbody>
</table>

Recorded music was chosen based on popular music the participants would have listened to in their young adult years. The album “100 Classic 1940s Memories” (© 2010 Goldenlane Records) was purchased off of iTunes and played using an iPod and small speaker. These were set in a central location where the music would be audible to all participants. Live music was performed using a classical acoustic guitar as accompaniment, a vocal melody provided by the music therapist, and song selections chosen by participants prior to the study.
Design

Two four-part, reverse baseline designs were used. At Facility X the design implemented was ABAC, where A was the no-music control condition, B was the recorded music condition, and C was the live music condition. At Facility Y the design implemented was ACAB were A was the no-music control condition, B was the recorded music condition, and C was the live music condition.

Independent Variable

The independent variable in this study was the type of music treatment: recorded or live music. Live music selections were chosen based on the results of the music-preference survey conducted during the recruitment process. As part of the interactive music therapy treatment, residents and participants could also request songs, discuss songs, and express thoughts and feelings about the music with the therapist.

Dependent Variable

The dependent variable in this study was the amount of food consumed by the resident, as a percentage of the amount of food that was “plated” or offered to them. Food intake was measured using the Waste Watchers Observation System (WWOS), a plate waste survey used by Munroe (1978) to determine the nutrient intake of school-age children. The WWOS was then adapted by Hansen and Dorsey (1983) to assess the nutrient intake of older adults in congregate meal settings, and was adapted again by the researcher for use in this study. The WWOS code includes: (+) to represent half or more of food portion remaining, (-) to represent less than half of food portion remaining, and (0) to represent no food portion remaining. The code was then converted to a numeric equivalent to generate individual and overall scores: (1) to
represent half or more of food portion remaining, (2) to represent less than half of food portion remaining, and (3) to represent no food portion remaining.

Table 2: Waste Watcher Observation System Form and Key

<table>
<thead>
<tr>
<th>Tray Number</th>
<th>Portion 1</th>
<th>Portion 2</th>
<th>Portion 3</th>
<th>Portion 4</th>
<th>Liquid/Supplement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>2</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>3</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>4</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>5</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>6</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>7</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
<tr>
<td>8</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
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<td>+ - 0</td>
</tr>
<tr>
<td>10</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
<td>+ - 0</td>
</tr>
</tbody>
</table>

Key to Table:
(+) = 50% or more of food portion remaining on plate
(-) = Less than 50% of food portion remaining on plate
(0) = None of food portion remaining on plate

Table 3: Waste Watcher Observation System Numeric Equivalents and Key

<table>
<thead>
<tr>
<th>Tray Number</th>
<th>Portion 1</th>
<th>Portion 2</th>
<th>Portion 3</th>
<th>Portion 4</th>
<th>Liquid/Supplement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 2 3</td>
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<td>1 2 3</td>
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<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>

Key to Table:
(1) = 50% or more of food portion remaining
(2) = Less than 50% of food portion remaining
(3) = None of food portion remaining
As orders for meals came into the kitchen, the researcher tagged the plates that were going to the participants by writing their assigned number on orange tape and fastening it to the bottom of the plate. Staff were instructed to receive verbal confirmation from the participant that he/she was done with their meal before removing the plates, then to set them aside in the kitchen for the researcher to analyze. All data would be recorded, each plate with its corresponding number on the WWOS form.
CHAPTER FOUR

RESULTS

Individual and aggregate scores were calculated using the adjusted WWOS form and by converting portion intake into its numeric equivalent. Participants would often receive a different number of portions from each other, so the variance was controlled for by adjusting the numeric equivalents into percentages. This adjustment allowed each participant to be scored only by how much they ate of what they were given. According to the number of portions received, each participant was given a “possible” score representing the score earned should the participant consume all of the given food. This score was calculated by multiplying the number of portions by 3, as a score of (3) represented no food remaining on the plate. Then each participant was given an “actual” score representing the actual intake of the participant. These two data were converted to percentages to represent total intake of one participant for the meal.

At each facility, percentages from all participants were averaged to produce the mean total intake score for that meal; for both of the no-music conditions (A\(^1\) and A\(^2\)), all scores were averaged a second time to produce the mean total intake for the no-music condition. The individual scores, percentages of intake, and mean intake for each condition can be seen in Tables 4–6.

A one-way within-subjects Analysis of Variance (ANOVA) was conducted to compare the effects of no music, recorded music, and live music therapy on the food intake of the participants.
Table 4: Scores and Mean Intake for the No Music Condition (A\textsuperscript{1} and A\textsuperscript{2})

<table>
<thead>
<tr>
<th>Participant</th>
<th>Possible Score</th>
<th>Actual Score</th>
<th>Percentage Eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility X - No Music Condition (A\textsuperscript{1} and A\textsuperscript{2})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>3</td>
<td>33.33%</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>5.5</td>
<td>61.10%</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>7.5</td>
<td>62.49%</td>
</tr>
<tr>
<td>4</td>
<td>10.5</td>
<td>5</td>
<td>48%</td>
</tr>
<tr>
<td>5</td>
<td>10.5</td>
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<td>42.85%</td>
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<tr>
<td>6</td>
<td>10.5</td>
<td>4.5</td>
<td>42.85%</td>
</tr>
<tr>
<td>7</td>
<td>10.5</td>
<td>6</td>
<td>57.14%</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>3</td>
<td>33.33%</td>
</tr>
<tr>
<td>9</td>
<td>10.5</td>
<td>8</td>
<td>76.19%</td>
</tr>
<tr>
<td>10</td>
<td>10.5</td>
<td>9</td>
<td>85.71%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean Intake: 50.92%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Participant</th>
<th>Possible Score</th>
<th>Actual Score</th>
<th>Percentage Eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility Y - No Music Condition (A\textsuperscript{1} and A\textsuperscript{2})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>6</td>
<td>50.00%</td>
</tr>
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<td>2</td>
<td>9</td>
<td>4.5</td>
<td>50.00%</td>
</tr>
<tr>
<td>3</td>
<td>7.5</td>
<td>2.5</td>
<td>33.33%</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>5</td>
<td>83%</td>
</tr>
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<td>5</td>
<td>9</td>
<td>6.5</td>
<td>72.22%</td>
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<td>12</td>
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<td>33.33%</td>
</tr>
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<td>7</td>
<td>7.5</td>
<td>4.5</td>
<td>60%</td>
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<td>8</td>
<td>7.5</td>
<td>3.5</td>
<td>46.66%</td>
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<tr>
<td>9</td>
<td>9</td>
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<td>89%</td>
</tr>
<tr>
<td>10</td>
<td>7.5</td>
<td>2.5</td>
<td>33.33%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean Intake: 55.10%</td>
</tr>
</tbody>
</table>
Table 5: Scores and Mean Intake for the Recorded Music Condition (B)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Possible Score</th>
<th>Actual Score</th>
<th>Percentage Eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>4</td>
<td>44.44%</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>6</td>
<td>100%</td>
</tr>
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<td>3</td>
<td>9</td>
<td>7</td>
<td>77.77%</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>7</td>
<td>58.33%</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>4</td>
<td>44.44%</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td>8</td>
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<td>66.66%</td>
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<td>66.66%</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>8</td>
<td>66.66%</td>
</tr>
</tbody>
</table>

Mean Intake: 67.49%

<table>
<thead>
<tr>
<th>Participant</th>
<th>Possible Score</th>
<th>Actual Score</th>
<th>Percentage Eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>7</td>
<td>77.77%</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>5</td>
<td>55.55%</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>5</td>
<td>55.55%</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>7</td>
<td>58.33%</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>4</td>
<td>44.44%</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
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<td>88.88%</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>4</td>
<td>66.66%</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>2</td>
<td>33.33%</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>7</td>
<td>77.77%</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>3</td>
<td>33.33%</td>
</tr>
</tbody>
</table>

Mean Intake: 59.16%
Table 6: Scores and Mean Intake for the Live Music Therapy Condition (C)

Facility X - Live Music Therapy Condition (C)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Possible Score</th>
<th>Actual Score</th>
<th>Percentage Eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>6</td>
<td>100%</td>
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<tr>
<td>3</td>
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<tr>
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<td>100%</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>10</td>
<td>83.33%</td>
</tr>
</tbody>
</table>

Mean Intake: 81.10%

Facility Y - Live Music Therapy Condition (C)

<table>
<thead>
<tr>
<th>Participant</th>
<th>Possible Score</th>
<th>Actual Score</th>
<th>Percentage Eaten</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>9</td>
<td>6</td>
<td>66.66%</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>5</td>
<td>44.44%</td>
</tr>
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<td>6</td>
<td>66.66%</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>9</td>
<td>100%</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td>6</td>
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</tr>
<tr>
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<td>8</td>
<td>66.66%</td>
</tr>
<tr>
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<td>9</td>
<td>5</td>
<td>55.55%</td>
</tr>
<tr>
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</tr>
<tr>
<td>10</td>
<td>9</td>
<td>6</td>
<td>66.66%</td>
</tr>
</tbody>
</table>

Mean Intake: 68.32%

The bar graphs in Figures 1-3 indicate differences for Facility X, Facility Y, and their combined data; however, there was not a significant effect on food intake at the p < .05 level for facility Y \( F = 1.23, p = .03 \). The results from facility X and the combined data from Facility X and Y indicated a significant effect of the live music variable on food...
intake at the $p < .05$ level. Results of the one-way analyses for each facility and their combined data are included in Table 7. For the results that demonstrated significance, a Tukey post-hoc test was conducted to compare the experimental conditions. The test indicated that the mean scores for the no music conditions ($M = 54.29$ and $54.69$, $SD = 17.53$ and $18.58$) were significantly smaller than the live music therapy conditions ($M = 81.10$ and $74.71$, $SD = 23.88$ and $21.81$). These results indicate that food intake was significantly greater during live music therapy conditions than during no music conditions. Tables 8-10 represent the means and standard deviations for each facility.

![Facility X: Percentage of Food Intake](image)

**Figure 1. Mean Percentage of Food Intake During Experimental Conditions for Facility X**
Figure 2. Mean Percentage of Food Intake During Experimental Conditions for Facility Y

Figure 3. Mean Percentage of Food Intake During Experimental Conditions with Combined Data for Facility X and Facility Y
### Table 7: Results of Analysis of Variance for Treatment Conditions

<table>
<thead>
<tr>
<th>Facility</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility X</td>
<td>4.19</td>
<td>0.026</td>
</tr>
<tr>
<td>Facility Y</td>
<td>1.23</td>
<td>0.3</td>
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<tr>
<td>Combined Results for Facility X and Facility Y</td>
<td>5.04</td>
<td>0.009</td>
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</table>

### Table 8: Means and Standard Deviations for Food Intake and Treatment Conditions

<table>
<thead>
<tr>
<th>Facility X</th>
<th>Condition</th>
<th>$M$</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>No Music</td>
<td></td>
<td>54.29</td>
<td>17.53</td>
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<tr>
<td>Recorded Music</td>
<td></td>
<td>67.49</td>
<td>20.2</td>
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<tr>
<td>Live Music Therapy</td>
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<td>81.1</td>
<td>23.88</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Facility Y</th>
<th>Condition</th>
<th>$M$</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Music</td>
<td></td>
<td>55.08</td>
<td>20.52</td>
</tr>
<tr>
<td>Recorded Music</td>
<td></td>
<td>59.16</td>
<td>18.88</td>
</tr>
<tr>
<td>Live Music Therapy</td>
<td></td>
<td>68.32</td>
<td>18.52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combined Results of Facility X and Facility Y</th>
<th>Condition</th>
<th>$M$</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Music</td>
<td></td>
<td>54.69</td>
<td>18.58</td>
</tr>
<tr>
<td>Recorded Music</td>
<td></td>
<td>63.32</td>
<td>19.5</td>
</tr>
<tr>
<td>Live Music Therapy</td>
<td></td>
<td>74.71</td>
<td>21.81</td>
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</tbody>
</table>
CHAPTER FIVE

DISCUSSION

General Discussion

The purpose of this study was to investigate the effect of live versus recorded music on the food intake of older adults in an assisted living facility. The results of this study show increases in food intake for both recorded music and live music when compared with no music; however, only live music compared to no music presented a significant difference. Both facilities showed a linear increase regardless of the design, with no music associated with the least intake and live music associated with the most. Furthermore, when the participants for both facilities were combined (N=20), the differences between the three conditions increased, indicating that the small sample size for each facility (n=10) may have contributed to less significant differences.

Observations of the residents revealed increases in several positive accompanying behaviors with both recorded music and live music therapy. When recorded music was played one resident commented that it was pleasant that the music masked the noise of the operations of the facility. Beeping machines, kitchen noise, and the buzz of resident aids and staff were masked by the music during meals, and another resident commented that this helped them feel more relaxed. During recorded music conditions, residents were overheard singing along to some of the familiar music. The music also seemed to stimulate an increase in conversation among table-mates, who discussed memories, thoughts, and feelings associated with the music.

During the live music therapy sessions, participants and other residents eagerly engaged in song-selection, and the playing of preferred music was associated with
more frequent smiles, laughter, conversation with the music therapist, and group singing. After the music therapist observed that singing along appeared enjoyable to the residents, the music therapist encouraged the residents to sing along if they liked. Though the dining halls were moderately large, about half of the room would be engaged in group singing during particularly well-loved songs. Residents were observed joking with one another about the song-selections, and many clapped along, tapped their hands and feet, or played “instruments” made out of their spoons and cups.

Staff exhibited more positive behaviors as well. Staff sang with the residents and participants, danced along, and verbally expressed pleasure and gratitude during the live music conditions. Though these positive behaviors were observed, there did not appear to be any significant change in their serving and clearing practices during meals.

The only negative response observed was during one of the recorded music conditions at one of the facilities. Per the experimental design, the researcher played popular music from the residents’ young adult years and did not take particular preferred music requests. One resident who wasn’t a participant in this study expressed great displeasure with one of the songs and requested that the song be changed. This resident made no further complaints after the researcher obliged this request, and appeared content with the rest of the music, and all of the music performed by the music therapist.

Limitations

Facility and Staff. Both of the facilities used in this study were chosen due to similarities in size and demographic. What could not have been predicted until the study was underway were the unique and dissimilar staff and serving practices and
procedures. Though the researcher was responsible for analyzing the food intake, taking the data required some cooperation from the serving staff who were responsible for getting the plates to the participants, getting verbal confirmation from participants when they had finished their meal, then bringing the plates back to the researcher at the end of the meal before clearing them. Though staff were educated and prepped in order to make the process smooth, the researcher often ended up having to enter the dining room and tag the plates while the participants were eating and watching participants carefully to make sure staff did not remove their plates before they were finished with their meal.

There were some inherent dining and serving problems already in place at one facility that contributed to the difficulty of the data collection, and possibly the nutritionally compromised state of the residents. Residents were sometimes not asked what they wanted to eat, and were just given the special menu item offered for that day. If this or any food did not appeal to the resident once it was served, the resident often did not ask for anything else, but simply skipped the entire meal rather than eat food they disliked. When asked why they did not request another menu item, the resident often stated that they “didn’t want the trouble”. Should two or more of these instances happen in a row, with no supplements via drinks or snacks, the resident would likely end up eating insufficient calories for that day.

Additionally, individual dietary constraints were not always monitored appropriately. Residents on special supplemented, textured, or pureed diets due to health conditions would sometimes be served food incompatible with their needs. In such cases, the food had to be sent back and re-ordered; however, due to the time
constraints of serving staff, the food was often not served until very late in the meal, then cleared away quickly, leaving the resident with very little time to eat. These flaws in dining and serving practices likely exacerbated malnutrition present at this facility, and contributed to the low food intake.

At the other facility, the dining and serving staff were more cooperative and willing to help with tagging and collecting plates for analysis. At this same facility, greater care was given to make sure the residents were satisfied with the food and staff, and the dining manager made rounds throughout the meals to ensure quality of service. Participants from this facility happened to be experiencing more severe health issues than those at the other, so though there was a difference in dining and serving practices, food intake was similarly low. As a result, though each facility was unique in regards to its operations, baseline intake was comparable from one facility to the other.

Participants. One of the qualifying criterion for inclusion in this study was malnutrition, so most of the participants in this study were experiencing some level of illness or had a pre-existing health condition. Participants would occasionally become too ill to leave their rooms, need to go to medical appointments, and in many cases were hospitalized for short periods during the study. In one case, a participant was admitted to hospice the day after the study was completed. What with these factors, it was highly unlikely that all participants would be present at the same time for each meal. Though there were only four parts to this study, the researcher had to be present for both the noon and evening meals every day for 6 weeks in order to get all of the necessary data for each resident. Occasionally a participant would not want to make the trip to the dining hall for the meal or would leave to eat off-campus with family or friends.
All this considered, very few of the participants’ data was gathered at the same time, but had to be taken over the course of many days.

*The Dependent Variable.* Measuring the food intake accurately depended on several things: that each participant was given the same portion size, that each participant had the same time to finish the meal, that each participant was finished eating at the time the plate was cleared, and that each participant had the ability to eat the items of food offered (if they had a pureed or textured diet, they were not given regular food). If any one of these things became inconsistent, inevitable inaccuracies would arise and the dependent variable could not be measured with perfect certainty. Most of these inconsistencies could be rectified in the course of the meal by the researcher or serving staff, and were overall not judged to be great enough to significantly impact results.

*Subject Bias.* Though the study was meant to be undertaken at a time the participants weren’t necessarily aware their food intake was being measured, if the researcher had to step into the dining hall to tag plates already served, residents could possibly have altered eating habits due to subject bias. This does not appear to have occurred with any significance; data taken when participants were potentially aware they were being analyzed is consistent with data taken when participants were potentially unaware they were being analyzed.

*Staff Bias.* Though staff were prepped and instructed regarding the nature and the parameters of the study, several servers were observed encouraging the participants to eat more during all the conditions. The researcher would address this behavior and explain the importance of not interfering with the residents’ typical intake
(encouraging or discouraging eating behavior), and data would be taken again. Despite the correction, staff still likely encouraged residents to eat from time-to-time when not observed by the researcher.

**Implications for Practice**

The most evident implication for practice is that live music, especially live music therapy, may be a valuable tool for assisted living facilities to encourage seniors who are at risk for malnutrition to eat more of their meals. Though other interventions to address malnutrition may be easier to implement and cheaper than hiring a music therapist, many assisted living facilities already have music therapists on staff, or contract out with a local music therapist for monthly groups or individual sessions. For any residents experiencing an acute need for nutritional intervention, meal-time music therapy may be an effective and non-invasive way to encourage adequate food intake, and an appropriate use of the music therapist at the facility.

If hiring a music therapist is out of the facility’s budget, live music in the form of volunteer performers might have a similar positive impact. Staff could encourage residents to sing along or make song requests, involving them in the music as much as possible without the presence of a therapist. Additionally, if even this were not achievable, simply playing recorded music with a CD player and speaker might have a positive impact in residents’ food intake. While neither facility had background music in use, the trends of this study indicate that this one simple and cost-effective measure may foster better caloric intake at meals.
Suggestions for Further Research

The sample size used in this study was relatively small which may have contributed to the lack of significance between some of the conditions. For each facility, a linear increase was observed, and it is possible that with a larger sample size this trend may approach or achieve significance, consistent with the implications in existing literature and the projection of this study. Using a larger sample size would also prevent critical road-blocks to the course of the study, should one or more of the participants become too ill to attend any further meals, be hospitalized, or be transferred to a skilled nursing facility due to medical complications.

If a replication study were to take place, the researcher could control for some of the limitations experienced in this study by a more in-depth examination of dining staff serving practices, and the overall facility dining program. Though such analyses were not possible for this study, careful observation of the setting in situ is implicated as important to control for inconsistent practices and pre-existing problems in the program. Given adequate time and the wherewithal to properly discriminate between different study sites, more similar facilities could be chosen.

Conclusions

It is important for society to always re-evaluate and continually improve methods for increasing quality-of-life for seniors. Especially in modern society where the population is rapidly aging, it is in the best interests of everyone to identify and dissolve barriers to living life as happily and healthily as possible. Key to life, and certainly quality-of-life, is adequate nutrition, without which the body cannot function properly. It is unfortunately one of the very things that can decline with age due to health-conditions,
medications, and loss of mobility. Luckily, health practitioners and long-term care agencies are already aware and looking to solve the problem using environmental modification, professional support, pharmaceuticals, and sensory stimulation. Previous studies have suggested that recorded music and human interaction contribute to increased food intake. Music therapy, the combination of auditory stimulation and therapeutic presence, is uniquely qualified to deliver both. Trends in the data of this present study suggest that music interventions are associated with increased food intake, and the results indicate that with live music therapy, that difference is significant.
APPENDIX A

MUSIC PREFERENCE SURVEY

1. Do you enjoy music?
   ____ yes  ____ no

2. What kinds of music do you enjoy? (check all that apply)
   __ Old Country (Hank Williams, Patsy Cline, Roger Miller, Johnny Cash)
   __ Jazz (Frank Sinatra, the Andrews Sisters, Dean Martin, Louie Armstrong)
   __ Gospel
   __ Hymns
   __ 50s and 60s Rock-and-Roll (Elvis Presley, Beatles)
   __ Oldies (Let Me Call You Sweetheart, Take Me Out to the Ball Game, Always, Tennessee Waltz, In the Good Old Summertime, or others)

3. Do you have a favorite song or hymn? Which one? ________________
4. Do you have a favorite singer? Who? ________________

Thank you for your answers!! You’re all done!!
APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL AND CONSENT FORM

Florida State University

Office of the Vice President for Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 08/18/2016

To: Meredith Bowden

Address: [Redacted]

Dept.: MUSIC SCHOOL

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research

The Effect of Live Versus Recorded Music During Mealtimes on the Nutritional Intake of Older Adults in an Assisted Living Facility

The application that you submitted to this office in regard to the use of human subjects in the research proposal referenced above has been reviewed by the Human Subjects Committee at its meeting on 11/18/2015. Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 11/16/2016 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to assure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00006446.

Cc: Alice-Ann Darrow <aadarrow@fsu.edu>, Advisor
HSC No. 2015.16290

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Consent Form with Authorization for Research

Principal Investigator: Meredith Bowden
Graduate Student in Music Therapy

Major Professor for Study: Dr. Alice Ann Darrow, PhD, MT-BC
Florida State University College of Music
850-645-1438

Reviewed by:
Florida State University Office of Research
Human Subjects Committee
2010 Levy Ave. Building B. Suite 276
Tallahassee, FL 32310
850-644-8673

You are being asked to take part in a research study examining the relationship between music and your nutrition.

Nutrition is a very important part of maintaining a healthy lifestyle, and can greatly impact your quality of life. Music is a great way to increase your quality of life, and might be a great way to enhance your nutrition too! A benefit of participating is that you may have healthier eating habits during parts of the study.

If you choose to participate in this study, you will fill out a brief survey. You will be presented with different kinds of music during your meals over the course of a couple weeks, and the amount of food that you eat will be recorded at the end of your meal by the staff.

Your participation in this study is voluntary, and if at any time you choose to not participate, there will be no penalty whatsoever. If you have any questions or would like to talk, please don’t hesitate to call any of the numbers that are listed at the top of this form.

The results of your survey and the information collected from this study will be kept strictly confidential to the extent allowed by law. To protect your privacy, no one will have access to them except the researcher.

Consent
I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form after I sign it.

______________ Name

______________ Date

REFERENCES


BIOGRAPHICAL SKETCH

Meredith Bowden is a native of South Carolina, where she began taking cello lessons at age six. She went on to become a competitive performer, and received a Bachelor of Music Performance degree from Oberlin Conservatory of Music in 2011. After a few years of freelancing as a performer and music teacher, Meredith changed direction and received her Master of Music Therapy degree from Florida State University in 2016. Meredith is a board-certified music therapist, and is the music therapist for the Center for Integrative Oncology at Greenville Memorial Hospital in Greenville, South Carolina, where she works as part of a medical team serving pediatric, adult, inpatient, and outpatient cancer patients.