Exploring Motivations Behind Food Choices of Collegiate Female Modern Dancers

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Abstract

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Exploring Motivations Behind Food Choices of Collegiate Female Modern Dancers

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Collegiate modern dancers comprise a population of athletes that have not been studied thoroughly in terms of diet and motivations for dietary choices. Professional ballet dancers are well-documented to have higher rates of disordered eating to achieve weight and aesthetic goals. However, it is unclear if collegiate modern dancers have similar dietary issues to professional ballet dancers; thus, recommendations based on studies of professional ballet dancers may not be appropriate to use with collegiate modern dancers. The purpose of this study is to analyze modern dancers at Ohio University to determine the adequacy of their diets, and to find themes in motivations behind their dietary choices in order to understand this population better and to provide guidelines for better, more specific nutritional care. The long-term goal is to better understand the dietary behaviors of these athletes to inform appropriate recommendations to improve their nutrition. The modern dancers studied in this research tended to be heavier and more physically active than ballet and modern dancers that have been studied in the past. Based on their intakes, they were not consuming an adequate diet compared to the recommended daily allowances (RDA) in the majority of nutrients. They reported consuming adequate amounts of kilocalories and total fat and inadequate amounts of zinc, iron, vitamin D, vitamin E, potassium, chloride, copper, and chromium.

Dedication

To my family who has supported me through all my endeavors and to Hannah, who has spent too much of her time helping me edit.

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Thank you to Dr. Jeff Russell for all of the time and aid he has provided me in the completion of this research. Thank you to all my committee members, Dr. Robert Brannan, Dr. Darlene Berryman, and Dr. Elizabeth Beverly for their advice and time and encouragement through this process. Thank you to the Ohio University Dance Department for the time and participation necessary to complete my research.

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Chapter 1: Introduction

Fundamentally, dance is entrenched in how dancers look and move in expressing their art (Best, 1975). Dancers' success in the performing arts depends on their skill, and equally on their appearance. Many dance genres have aesthetic requirements that emphasize slender body size and low weight for optimum performance and appearance, ballet being the foremost (Twitchett, Angioi, Metsios, Koutedakis, & Wyon, 2008; Warren & Cook, 1989). Due to the emphasis on their appearance, many dancers choose restricted diets to achieve a low-weight, slender body type that may not naturally be attained (Twitchett, Koutedakis, & Wyon, 2009; Weslin & Silva-Smith, 2010). Exercise outside of dance and dance practice is often neglected in fear of becoming too muscular and moving away from the body shape desired, resulting in a reliance on diet alone to lose weight (Koutedakis & Jamurtas, 2004; Russell, 2013).

A diet adequate in calories and other nutrients is essential for all athletes, including dancers, for them to perform optimally. Insufficient dietary intake in women increases the risk of female athlete triad, which over time can lead to a high risk of osteoporosis development later in life (Barrack et al., 2014; Borer, 2005; Brown, Wengreen, & Beals, 2014; Doyle-Lucas, Akers, & Davy, 2010; Hincapié & Cassidy, 2010; Nattiv et al., 2007; Sangenis et al., 2005; Thomas, Erdman, & Burke, 2016; Weslin & Silva-Smith, 2010). Poor dietary intake is also closely linked with increased risk of injuries and illness, preventing the dancer from practicing in the short-term if less serious, or even ending the dancer's career if the injury or illness is severe (Thomas et al., 2016). As a result, studies have examined dancers' actual dietary intake to understand the nutritional needs of this population in order to make specific recommendations

(Burckhardt, Wynn, Krieg, Bagutti, & Faouzi, 2011; Doyle-Lucas et al., 2010; Ziegler, Jonnalagadda, & Lawrence, 2001). Professional ballet dancers have been studied extensively, and they appear to be an at-risk population for eating less than the daily recommended amounts and for eating disorders to achieve their aesthetic requirements (Doyle-Lucas et al., 2010; Friesen et al., 2011; Hincapié & Cassidy, 2010; Koutedakis & Jamurtas, 2004; Liu, Tseng, Chang, Fang, & Lee, 2016; Nascimento, Luna, & Fontenelle, 2012; Penniment & Egan, 2012; Weslin & Silva-Smith, 2010; Ziegler et al., 2001). Each genre of dance has its own aesthetics and practices, so assuming that all dancers have the same nutritional issues may also be a fallacy. Modern dancers have different performance requirements, and the differences in performance are reflected in their bodies, with most being slightly heavier and having higher body fat percentages (Angioi, Metsios, Twitchett, Koutedakis, & Wyon, 2009; Friesen et al., 2011; Swami & Harris, 2012).

There also are considerable differences between professional dancers and collegiate dancers. Professional dancers dance as a career; dancing is their sole focus. Collegiate dancers have additional demands on their time and attention, such as additional classwork and part- or full-time jobs unassociated with dance, and may have different career goals than those who dance professionally (Russell, 2013). These additional factors may have an impact on their dietary choices, and their motivations behind their diets may be different from those of professional dancers.

Although professional ballet dancers have been thoroughly studied, there is a gap in the literature as to the dietary needs and issues related to collegiate modern dancers. Ballet is the most studied dance form and, thus, many studies focus on the nutritional issues and inadequacies of elite or professional ballet dancers. However, professional

ballet dancers are on a very different level than college dancers (Burckhardt et al., 2011; Doyle-Lucas et al., 2010; Doyle-Lucas & Davy, 2011; Koutedakis & Jamurtas, 2004; Nascimento et al., 2012; Penniment & Egan, 2012; Russell, 2013; Twitchett et al., 2008, 2009; Weslin & Silva-Smith, 2010; Yannakoulia, Keramopoulos, Tsakalakos, & Matalas, 2000). It is necessary to look at the diets of collegiate dancers and understand the motivations behind their diets in order to develop nutritional advice and guidelines for this population.

In light of what is known about dancers' nutritional practices and the gaps that exist in understanding them, the purpose of my study was to analyze modern dancers at Ohio University to determine the adequacy of their diets, and to find themes in motivations behind their dietary choices in order to understand this population better and to provide guidelines for better, more specific nutritional care. The research questions of this thesis are shown in Table 1.

Table 1

Research Questions and Hypotheses

Research Question	Hypothesis
Are dancers at Ohio University reaching the RDA values for macro- and micro-nutrients, and if not, what nutrients are lacking?	The dancers consume insufficient kilocalories and total fat.
What are the motivations behind the food choices of Ohio University dancers?	

Delimitations

The study took place in the spring and summer months of 2015 at Ohio University. A maximum of 20 participants were recruited. The total potential population at Ohio University is small, with approximately 65 dancers total, so limiting the study to 13 was anticipated to give a representative sample as well as saturation, without being amenable to analysis. The dance program at Ohio University is modern/contemporary dance, so dancers recruited had a focus on modern/contemporary dance, with possible other genres of dance as subfocus areas. Collection of 3-day food logs took place during 2 weekdays and 1 weekend day over a 1-week period for each dancer and was completed by participants at a time of their choosing. Participants were between ages 18 and 30 years, which represented typical ages of dance students at a university level. They were also dance majors which indicated that dance is their focus of study, with plans for future careers related to the dance profession. Five years of dancing experience prior to enrollment to Ohio University was required to ensure that participants had backgrounds

in dance and had been exposed to dance culture and experience before participating in this study.

Male dancers were excluded from this study because males comprise a small fraction of the Ohio University dance department and there was an anticipated lack of male dancers available to participate in this study. Lacking a representative number of male participants, data from a single male dancer could skew results or pose a risk to data confidentiality.

Dance majors who were not currently dancing, for whatever reason, were excluded to ensure that participants who were undergoing the physical demands of dance at the time of the study. Dancers with minor injuries that excluded them from dancing for a month or less were eligible to participate because they were able to resume dancing for the duration of this study; however, dancers with injuries that precluded them from dancing for longer than a month were excluded.

Pregnant and lactating dancers were excluded due to changes in both nutritional and physical recommendations and to avoid introducing confounding variables. Students who were pursuing a major or minor in nutrition, dietetics, exercise physiology, or athletic training were excluded due to the possible introduction of bias through their coursework and knowledge of nutrition that could affect their self-reported data. Additionally, studying these majors or minors increased the likelihood of the participating students knowing the investigator, which could have biased the information gathered and analyzed.

Dancers older than 30 years and younger than 18 years were excluded due to not being typical of university-level dancers and to avoid introducing confounding variables

related to their physical maturity and lifestyle. Dancers who were currently undergoing treatment for an eating disorder were also excluded because participants were asked to disclose diets of their own choosing, whereas individuals undergoing treatment for an eating disorder could be consuming a medically prescribed diet. The eating disorder screening tool "SCOFF" was included in the demographics questionnaire and was used at the beginning of the study to identify and exclude potential participants at high risk of having an eating disorder.

Limitations

There were some limitations that were anticipated with this thesis. Underreporting food intake is a common issue when requesting that participants keep a food log to be studied (Dorgan et al., 1996). This issue was addressed by having subjects take digital pictures of the foods eaten throughout the day to increase accuracy and to allow the investigator to accurately input and analyze the dietary intake through nutritional analysis software (Lagowska, Kapczuk, Friebe, & Bajerska, 2014; Martin, Han, Coulon, Allen, Champagne, & Anton, 2009). Photographs combined with written food records have increased reports of total calories consumed by participants compared to written food logs alone (Ptomey, Willis, Goetz, Lee, Sullivan, & Donnelly, 2015).

Another anticipated problem was the social desirability bias and self-report of the participants during the interview. Subjects might feel uncomfortable disclosing personal or sensitive information about eating patterns and reasons for their dietary choices, and so might not give accurate information.

The investigator could introduce some bias during interpretation of the data, because the information was largely qualitative. Coding issues were addressed by using

outside resources to maintain proper coding and having an experienced qualitative researcher help code the interviews. Also, an outside transcriber transcribed the interviews and an outside researcher experienced in qualitative research helped interpret of the interviews.

Definition of Key Terms

Adequate intake (AI). Sex- and age-based recommendations for daily nutrient intake that require more research before becoming RDAs (Otten, Hellwig, & Meyers, 2006).

Adequate macronutrient distribution range (AMDR). The proportions of fat, carbohydrate, and protein that comprise a healthy diet (Otten et al., 2006).

Body dysmorphic disorder (BDD). The perception of some part of the body being disfigured or "ugly" when considered "normal" in reality (Phillips, 2004).

Body mass index (BMI). A measure of body fat that is the ratio of the weight of the body in kilograms to the square of its height in meters. A BMI in adults of 19-24.9 is considered healthy; 25 to 29.9, is an indication of overweight; and, 30 or more, is an indication of obesity (Brooks, Fahey, & Baldwin, 2005).

Credibility. The quality of findings that represent some sense of reality, particularly the participant's reality in qualitative research (Savin-Baden & Major, 2012).

Dependability. The ability of research findings to endure over time given the context and the methods used (Savin-Baden & Major, 2012).

Eating disorder (ED). Clinical mental disorders characterized by "abnormal eating behaviors, an irrational fear of gaining weight, and false beliefs about eating, weight, and shape" as defined by the DSM-IV (Nattiv et al., 2007, p. 1869).

Estimated average requirement (EAR). The amount of a nutrient adequate for about half of the population (Otten et al., 2006).

Female athlete triad (Triad). "Relationships among energy availability, menstrual function, and bone mineral density that may have clinical manifestations including eating disorders, functional hypothalamic amenorrhea, and osteoporosis" (Nattiv et al., 2007, p. 1869).

Functional hypothalamic amenorrhea (FHA). Absence of menstration for longer than 3 months that is unrelated to a nonfunctional hypothalamus (Nattiv et al., 2007).

Osteoporosis. Loss of bone mineral density that is 2.5 SD below the mean for the corresponding population (Borer, 2005).

Recommended daily allowances (RDA). Sex- and age-based recommendations for daily nutrient intake (Otten et al., 2006).

Saturation. A point at which no new themes are uncovered during qualitative data collection (Savin-Baden & Major, 2012)

Semistructured interviews. Interviews where the researcher not only follows some preset questions, but also includes additional questions in response to participant comments and reaction (Savin-Baden & Major, 2012).

Tolerable upper limit (UL). The highest level of a nutrient that can be consumed without risking toxicity (Otten et al., 2006).

Chapter 2: Review of the Literature

Dance is a unique combination of artistic expression and athleticism. Dancers, like all athletes, must practice extensively and have pressures to achieve optimum performance, though dance also requires the body to be aesthetically pleasing. The focus on a dancer's body has made dancers an at-risk population for disordered eating and eating disorders (Burckhardt et al., 2011; Doyle-Lucas et. al., 2010; Swami & Harris, 2012; Twitchett et al., 2008; Yannakoulia et al., 2000). The very specific aesthetic requirements for a ballet dancer's body has made ballet one of the most studied dance genres with regard diet and disordered eating. Previous research mainly studied professional dancers, leaving the large population of collegiate dancers, who potentially have different dietary habits and motivations, understudied (Burckhardt et al., 2011; Doyle-Lucas et al., 2010; Doyle-Lucas & Davy, 2011; Koutedakis & Jamurtas, 2004; Nascimento et al., 2012; Penniment & Egan, 2012; Twitchett et al., 2008, 2009; Weslin & Silva-Smith, 2010; Yannakoulia et al., 2000). Studies determining the nutritional adequacy of these diets, and the reasons for dancers' food choices may provide insight into ways dance instructors and health care professionals can help them achieve optimum nutrition and identify potential triggers for ill-advised dietary practices.

Adequate Diet for Athletes

Dietary recommendations. Diet is a key aspect of health for any person, but is particularly crucial for athletes wishing to have successful careers. Therefore, it is necessary to understand the components of an adequate diet for athletes and how such a diet differs from one designed for nonathletes. It is important to note that many countries

have their own standards for nutritional recommendations. However, only the standards of the United States will be discussed herein.

The U.S. Department of Agriculture uses Dietary Reference Intakes (DRIs) developed by the Institute of Medicine to make macronutrient and micronutrient recommendations for the general population. The macronutrient recommendations are represented by the Acceptable Macronutrient Distribution Ranges (AMDRs) to identify the proportions of fat, carbohydrate, and protein that comprise a healthy diet (Otten et al., 2006). Micronutrient recommendations come in four variations: Recommended Daily Allowance (RDA), Adequate Intake (AI), Estimated Average Requirement (EAR), and Tolerable Upper Limit (UL) (Otten et al., 2006).

RDA, EAR, and AI both provide sex- and age-based recommendations for daily nutrient intake. The RDA recommendations are more strongly supported by research,whereas the AI is newer and more subject to change as evidence is aquired (Otten et al., 2006). Typically, intake of 70% of the RDA or AI recommendation for a given nutrient is deemed sufficient to meet the daily needs for most people, unless signs and symptoms of a deficiency are present, while EAR indicates the amount of the nutrient adequate for about half of the population (Otten et al., 2006). EAR is more suited for studying a population's intake, while RDA is used to study an individual's intake. UL indicates the highest level of the nutrient that can be consumed without risking a toxicity; this level is not known for all nutrients, depending on the nature of that nutrient and current research. These recommendations provide an adequate diet, and while daily or even weekly fluctuations in nutrient intake can be tolerated, long-term deviations from these recommendations result in an inadequate diet.

Dietary recommendations for athletes. The major difference in nutritional guidelines for athletes is that recommendations for athletes' intake of carbohydrates and proteins reach the higher ends of the AMDRs (Thomas et al., 2016). One other difference is that while 70% of the RDA is adequte for the general population, 100% is recommended for athletes because of their higher caloric needs, increased metabolic processes, and additional loss of some nutrients through sweat (Thomas et al., 2016). Vitamin and mineral supplements are discouraged, except in specific cases such as apparent deficiencies, for athletes who follow diets that exclude certain foods or food groups, or athletes who follow calorie-restricted diets (Thomas et al., 2016). In the latter two cases, these athletes risk inadequate intake of specific nutrients or the inability to obtain enough nutrients through diet alone. Nutrients that are most commonly consumed in inadequate amounts for athletes are calcium, vitamin D, B vitamins, iron, zinc, magnesium, vitamin C, vitamin E, beta carotene, and selenium (Thomas et al., 2016).

Substance Use in Dancers

There is a dearth of research related to substance use and abuse in the dance population. The term "substance" is a general term that encompasses, but is not limited to, nicotine and tobacco products, alcohol, caffeine, non-prescribed drugs, and illegal and/or recreational drugs such as marijuana. Nicotine is of particular interest because of its perceived relationship with weight loss and maintenance (Perkins, 1992).

Smoking is believed to cause weight loss due to an increase in metabolic rate and blunting of appetite; however, studies examining this effect seem inconclusive (Dallosso & James, 1984; Robinson & York, 1986; Stamford, Matter, Fell, & Papanek, 1986; Wack & Rodin, 1982). There may be short-term effects that differ from long-term effects of

nicotine use. Yet, varying factors such as frequency and timing of last dosage creates barriers to comparison among studies that explore the relationship between nicotine and metabolic rate (Dallosso & James, 1984; Robinson & York, 1986; Stamford et al., 1986; Wack & Rodin, 1982).

Acute effects of nicotine on metabolic rate have been noted by several studies over the past 50 years (Dallosso & James, 1984; Perkins, Epstein, Stiller, Marks, & Jacob, 1989; Stamford et al., 1986). It is suggested that due to the regularity of nicotine use by users, the acute effects could be renewed often enough to have a significant effect on metabolic rate. This effect on metabolic rate could be sustained over a long period of time, even if there is not a chronic increase in metabolic rate caused by nicotine use (Perkins, 1992).

One notable study by Peric, Zenic, Sekolic, Kondric, and Kaletel (2016) evaluated the relationship between the frequency and type of substance use, eating disorders, and amenorrhea (Peric et al., 2016). This study evaluated elite female ballet dancers on their drinking, tobacco, recreational drug, and painkiller usage and frequency as well as their menstrual function and eating disorder risk. Peric et al. (2016) found that approximately a quarter of their subjects binge-drank once a month and smoked on a daily basis (Peric et al., 2016). The study revealed that over a third of the subjects consumed recreational drugs such as marijuana while 90% took painkillers on an occasional or frequent basis (Peric et al., 2016). Over half of the subjects (63%) also reported attempts at weight loss or were currently attempting to lose weight (Peric et al., 2016).

Peric et al. (2016) found a correlation between increased alcohol consumption and higher scores on the eating disorder screening tool and the presence of amenorrhea. This

relationship between alcohol consumption and eating disorders is not expected due to the calories that alcohol contributes. Peric et al. (2016) speculated that this may be due to the positive energy balance that alcohol consumption perpetuates, which leads to frustration with weight and inability to lose weight and, as a result, furthers eating disorder behaviors in dancers who may not be aware of this effect of alcohol (Peric et al., 2016).

There was no correlation between tobacco use and eating disorders seen in Peric et al.'s study (2016). This result is surprising considering the reports of tobacco users using tobacco as a weight loss or maintenance method (Wack & Rodin, 1982). It can be concluded that there is a need for more research in this area with ballet and other forms of dance to determine if there is a significant, positive relationship between substance use and dancers, and if so, the reasoning behind the usage.

Disordered Eating, Eating Disorders, and Body Dysmorphic Disorder

Disordered eating. Disordered eating is a blanket term defined by the American College of Sports Medicine (ACSM) Position Statement on Female Athlete Triad as, "various abnormal eating behaviors, including restrictive eating, fasting, frequently skipped meals, diet pills, laxatives, diuretics, enemas, overeating, binge-eating and then purging (vomiting)" (Nattiv et al., 2007, p. 1869). The ACSM recognizes "eating disorders" as clinical mental disorders characterized by "abnormal eating behaviors, an irrational fear of gaining weight, and false beliefs about eating, weight, and shape" as defined by the DSM-IV (Nattiv et al., 2007, p. 1869). The term "disordered eating" will be used herein unless citing articles that used participants who were diagnosed with eating disorders.

Disordered eating is more common in athletes who participate in weight-sensitive sports, such as dance, gymnastics, wrestling, crew, and running, among others (Sundgot-Borgen et al., 2013). A meta-analysis of the prevelence of eating disorders in the general population estimated that there was a lifetime risk of approximately 2.7% in the United States (Qian, Hu, Wan, Li, Wu, Ren, & Yu, 2013). Weslin and Sylvia-Smith (2010) estimated that compared to the general population, dancers (unspecified genres) have up to 22% greater risk of developing of an eating disorder. Nascimento et al. (2012), in their study examining the association between body dysmorphic disorder and eating disorders, found that ballet dancers' rate of eating disorders and disordered eating was 17% higher than their nondancing counterparts. Three out of the 19 participants were either diagnosed previously with an eating disorder, or had indications of disordered eating. Liu et al. (2016) studied high school dance students learning ballet, traditional Chinese dance, and modern dance; they found that 15% of their dance population exhibited disordered eating (Liu et al., 2016). Both Nascimento et al. (2012) and Weslin & Silva-Smith (2010) hypothesized that prolonged exposure to full-size mirrors during practices could play a role in the development of body dysmorphic disorder and may provide a link between body dysmorphic disorder and disordered eating.

Eating disorder development. Sundgot-Borgen (1994) examined risk and trigger factors for eating disorders in female elite athletes of various sports and identified commonalities among the athletes displaying disordered eating behaviors. They found that athletes who participated in aesthetic and endurance sports on average had leaner bodies, higher training volumes, and higher rates of eating disorders than in other sports. Forty percent of endurance female athletes and 75% of aesthetic female athletes were

flagged for being at high risk of eating disorders, as well as 66% of female athletes in weight-class sports. Melin, Tornberg, Skouby, Møller, Faber, Sundgot-Borgen, & Sjödin (2016) examined the diets of female athletes who participated in endurance running and found that endurance female athletes had a high risk of disordered eating (DE)/eating disorders (ED). This was evident after 11 of the 45 subjects recruited indicated they were at high risk of DE/ED and were therefore excluded from the remainder of the study.

Research by Sundgot-Borgen (1994), with which subsequent studies agreed, identified six major risk/trigger factors in the development of eating disorders in athletes: dieting at an early age, the coach recommending the athlete lose weight, unsupervised dieting, restrictive diets/weight cycling, the athlete feeling they have reached menarche too early despite being within the normal age-range, and early sport-specific training (Sangenis et al., 2005; Sundgot-Borgen et al., 2013; Torstveit & Sundgot-Borgen, 2005). Age of menarche and early sport-specific training are of particular interest. Athletes are often pushed to begin sport-specific training at a young age, typically before menarche (Sundgot-Borgen, 1994; Torstveit & Sundgot-Borgen, 2005). Weight-sensitive sports emphasize leanness at an early age and have high training volumes, causing many female athletes in these sports to reach menarche later than their nonathletic counterparts (Burckhardt et al., 2011; Sundgot-Borgen, 1994; Torstveit & Sundgot-Borgen, 2005). Females who reach menarche earlier than their athletic peers may feel disadvantaged due to the development of adult features that alter their body shape and function (Sundgot-Borgen, 1994). Females who begin sport-specific training before menarche may find that their mature body is not ideal. Therefore, during the development of adult features,

female athletes may feel increased pressure to diet in order to maintain the body shape ideal for their sport (Sundgot-Borgen, 1994).

Adequate dietary intake of female athletes in weight-sensitive sports is critical in the prevention of ED development. A study done by Zeigler et al. (2001) analyzed the dietary intakes of elite figure skaters, both male and female, and determined that female skaters' diets were less adequate than males' overall (Ziegler et al., 2001). The average BMI of the female skaters was 20.5 with a 17.6% body fat percentage, which, while within the healthy range, is on the low end for females (Ziegler et al., 2001). The female skaters in the study had inadequate energy and carbohydrate intakes with high fat intakes. Overall, the female skaters met all vitamin intake recommendations except for folate. However, the study also found that based on recommendations, mineral intake was inadequate, particularly for calcium, zinc, and iron.

Calcium intake is a major concern for this population, since it is a key nutrient for bone health. The combination of low energy intake and low calcium intake can lead to bone mass loss and the development of osteoporosis later in life. Melin et al. (2016) looked at the dietary habits of female endurance runners and found that low energy-density and high fiber diets had low energy availability and these runners were at a higher risk of developing functional hypothalamic amenorrhea (Melin et al., 2016). The subjects with the least energy availability had the highest training volumes and energy expenditure (Melin et al., 2016). The subjects with functional hypothalamic amenorrhea (FHA) had lower body fat percentages but were not significantly different from their eumenorrheic controls in body weight, BMI, and exercise capacity (Melin et al., 2016). The FHA subjects who had lower energy-density diets that were higher in fiber and lower

in fat, exhibited greater concern over gaining weight, and scored higher on the ED screening tools than the eumenorrheic controls (Melin et al., 2016). Inadequate energy intake is the leading cause of the development of FHA and osteoporosis

Body dysmorphic disorder (BDD). BDD is characterized by the perception of some part of the body being disfigured or "ugly" when considered "normal" in reality (American Psychiatric Association, 2013). It is a diagnosable disorder by the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) as either a somatoform or delusional disorder, depending on the symptoms exhibited (American Psychiatric Association, 2013). However, BDD often goes undiagnosed, or, because of its high comorbidity with other psychological disorders such as depression, obsessive compulsive disorder (OCD), and ED, is commonly misdiagnosed, resulting in inappropriate treatments (American Psychiatric Association, 2013; Phillips, 2004). For example, if a person is diagnosed with and treated for an eating disorder, but that individual has BDD, then their treatment for the eating disorder may not be successful because their eating disorder was secondary to the BDD. BDD is thought to be more prevalent among dance populations than the general population. Both Nascimento et al. (2012) and Weslin and Silva-Smith (2010) hypothesized that prolonged exposure to full-size mirrors during practices could play a role in the development of BDD and may provide a link between BDD and DE. Nasciemento et al. (2012) found that 10.5% of their ballet population showed signs of having BDD, which is six times higher than that found in the general population. BDD could be higher in dancers because of the frequent exposure to mirrors and the pressures to meet expectations regarding body size and shape (Nascimento et al., 2012; Nattiv et al., 2007). It is clear that ED and BDD are two very problematic sources

of inadequate nutrient intake that can affect dancers. Understanding these disorders and treating the root cause early is critical for the health and outcomes of those afflicted with these conditions.

Health Risks Associated with Inadequate Diet

Health consequences of not obtaining the DRI for macro- and micronutrients range from immediate to chronic, with many manifestations. The most immediate consequence, and one of the most compelling for athletes and dancers to avoid, is the increased risk of injury and illness (Russell, 2013; Twitchett et al., 2008; Weslin & Silva-Smith, 2010). Injuries could occur with low energy intake because low energy intake over time can cause loss of bone mass that can contribute to injuries (Barrack et al., 2014; Doyle-Lucas et al., 2010; Nattiv, Aurelia et al., 2007). Twittchet et al. (2008) found that low body fat percentage and ectomorphy were associated with increased time taken off for injury or illness (Twitchett et al., 2008). Low body fat and ectomorphy can occur with proper diet and exercise, or as a natural body type, but often are obtained through reducing calories below adequate levels (Weslin & Silva-Smith, 2010). Affected dancers would have to abstain from practicing for longer periods of time because low energy intake also impairs the immune system and slows wound healing (Thomas et al., 2016).

Injury rates related to diet. Low energy intake and availability increases the risk of injury in female athletes due to loss of bone mass and development of osteoporosis over time. Weight-sensitive sports often emphasize lean builds and physiques. This body type is often achieved through low energy intake which can cause dysmenorrhea and lead to loss of bone mass and osteoporosis over time. The loss of bone mass due to dysmenorrhea, low energy availability, and low intake of calcium and vitamin D

increases the risk of injury, particularly bone fractures and breaks. Bone stress injuries (BSI) are estimated to affect up to 52% of the female endurance athlete population (Barrack et al., 2014). Barrack et al. (2014) evaluated the relationship between BSI and risk (Barrack et al., 2014). Barrack et al. (2014) found that 11% of their participants had experienced a BSI, and that most of these participants were endurance runners. Most of the BSI were found in the tibia and metatarsals of these athletes (Barrack et al., 2014). Three major risk factors for the incidence of a BSI were identified by Barrack et al. (2014): increased training volume (defined as over 12 hr a week of purposeful exercise), low bone mineral density (defined as less than -1 SD from the population's average), and a combination of low BMI (less than 18.5), participation in a weight-sensitive sport, oligo-/amenorrhea, and dietary restraint (Barrack et al., 2014). The study calculated that for participants who exhibited only one of these risk factors, the risk of a BSI was 15-21%. The risk of a BSI increased to 21-30% for participants who exhibited two of these risk factors and to 29-50% for participants with three risk factors (Barrack et al., 2014). Twittchet et al.'s (2008) study on somatotype and its relation to injury in dancers agrees with Barrack et al. (2014) in that an ectomorphic body type with low body fat showed a highly significant correlation between the frequency of acute injuries and the amount of time taken off dancing due to injury. More frequently than males, females exhibited the ectomorphic somatotype, experienced more acute injuries, and required greater amounts of time off due to these injuries (Twitchett et al., 2008).

Dance Bodies: Ballet and Modern Dancers

Ballet and its relation to the "dance body". The development of the current view of a dancer's body, namely the "ballet body," is relatively recent. During the height

of classical ballet in the Romantic period of the 18th and 19th centuries, ballerinas were light, but often depicted with more traditionally feminine bodies (Banes, 1998; Ritenburg, 2010; Vincent, 1989). Drawings from that time period show the ballerinas with large busts and hips and very narrow waists (Banes, 1998; Vincent, 1989).

These ballerinas often were cast as unearthly figures, and, to give an ethereal effect, they would balance briefly on their toes, *en pointe*, with the aid of wires to keep them up and to make them appear weightless (Vincent, 1989). This effect became more popular as time progressed and encouraged more *en pointe* work and the development of more supportive pointe shoes. The development of pointe shoes influenced the need for a lighter, stronger ballerina to incorporate *en pointe* work during performances; but, up until the early 1900s dancing *en pointe* was still reserved only for the premiere ballerinas of the time and not the majority of the dancers (Laemmli, 2015; Vincent, 1989). Ballerinas were still slender but not unhealthy through the 1800s and early 1900s. This can be seen in drawings and pictures of Fanny Cerrito (1840s) and Tatiana Riabouchinska (1920s). In the case of Cerrito, she appeared somewhat heavy, though her artist's depiction exhibits a narrowed waist and gives the appearance of weightlessness compared to her photograph (Vincent, 1989).

From the second half of the 20th into the 21st century, the trend has moved toward thinner and thinner ballerinas (Vincent, 1989). The aesthetic shift to thinner dancers, particularly in American ballet, can be attributed to George Balanchine and his popularization of *pointe* shoes for all members of a ballet company. Balanchine was a dancer and choreographer who emigrated from Russia to America in the 1930s (Lee, 1999). He founded the New York City Ballet (NYCB), and through his choreography and

developments in ballet, had a successful career and a dramatic impact on the current view of the dancer body that we know today.

One large contribution by Balanchine was the use of *pointe* shoes in his choreography. Until his work, *pointe* shoes were still largely reserved for prima ballerinas (Laemmli, 2015). However, Balanchine favored their use by the whole company, and this not only changed how *pointe* shoes were used, but it also sparked the creation of the modern *pointe* shoe (Laemmli, 2015). Balanchine preferred *pointe* shoes that were light and relatively unsupported to make them less unobtrusive, as well as to force his dancers to develop the strength and skill needed to use them well (Laemmli, 2015). *Pointe* shoes at that time were large, very hard and supportive shoes that Balanchine thought broke up the line of the dancer's leg and foot (Laemmli, 2015). Balanchine's shoe was lighter and more form-fitting to the foot, allowing the leg to flow seamlessly in line with the foot and toe (Laemmli, 2015).

Balanchine desired the look of long, thin legs that formed an unbroken line from hip to toe, and using this lighter shoe encouraged the muscular development of the legs, thus resulting in long, lean limbs (Laemmli, 2015). Using this less supportive *pointe* shoe also encouraged the dancer to be thinner, thus decreasing the weight that the foot and toes would have to support. Thinness augmented a ballerina's ethereal and graceful appearance and supported the look that Balanchine desired. This dynamic between the shoes and the choreographer instilled in ballet the slender, long-limbed ballerina ideal.

Current issues with the "dance body". Balanchine's influence on the ideal ballet body still is seen today. Current researchers studying dancers' bodies agree that low BMI and body fat percentages are typical (Burckhardt et al., 2011; Doyle-Lucas et.

al., 2010; Swami & Harris, 2012; Twitchett et al., 2008; Yannakoulia et al., 2000). Wainwright and Turner (2004) suggest that "skeletal, hyperflexible bodies" are the current aesthetic ideal body for dancers, which aligns with the need for low BMI and body fat percentages reported in the literature.

The impact on eating habits and mental health also are well documented, with dancers being identified as a population at high risk of developing eating disorders and body dysmorphic disorder (Friesen et al., 2011; Hincapié & Cassidy, 2010; Liu et al., 2016; Nascimento et al., 2012; Penniment & Egan, 2012; Weslin & Silva-Smith, 2010). However, Ritenburg (2010) argued that dance companies are not working to change the picture of the ideal dance body. Rather, they are still reinforcing it as the ideal and simply responding to the resulting issues that arise because of this ideal. Some companies are attempting to rebel against the traditional dance body by including different ages, body types, and combining dancers with different mobility capabilities (such as the World Center for Integrated Dance & Art). However, these dance companies are few in number (Ritenburg, 2010). The picture of the "dance body" is synonymous with ballet, but is often applied to all dance genres, which may be an unfair application, since other genres (e.g., modern/contemporary, world/ethnic, jazz, tap) have very different stylistic and aesthetic ideals.

The development of the modern dance genre. Modern dance started to emerge around the 1920s (Banes, 1998). The development of modern dance is often attributed to three women: Loïe Fuller, Isadora Duncan, and Ruth St. Denis (Banes, 1998). The movement from classical ballet and other structured dance forms to the freeform movements of modern dance mirror the change in times from corsets to loose-fitting

attire worn by women (Banes, 1998). Ballet before the 1920s used corsets in their costumes, as well as the traditional ballet slippers and many props and costumes. Fuller, Duncan, and St. Denis were remarkable in the 1920s because they removed corsets and slippers, and often danced in loose clothing and bare feet (Banes, 1998). These pioneers of modern dance can be viewed as representations of three large modernizations of the time: electricity, women's liberation, and exposure to and acceptance of other cultures from around the world (Banes, 1998).

Modern dance, along with art and music, focused on natural movements and expressions, rather than on the strict and rule-bound choreography of ballet and similar forms of dance (Banes, 1998). Ballet was very story and music driven, but modern dance often did not tell a story; it used the body to express emotions or impressions. Ballet typically had many dancers on stage, with most dancing minor roles and a select few as the principal dancers. Modern dances that developed in the 1920s used fewer dancers, sometimes only one (Banes, 1998).

Modern dance choreography was less defined, as well, with the choreographers often having to create their own vocabulary for the moves that the dancers performed (Banes, 1998). Often the choreographer was the dancer, which was a deviation from ballet where the choreographer rarely danced in his or her own creations (Banes, 1998).

Modern dance is very much a reflection of society at a given point in time. The modern dances created around and after World War I were often dark and chaotically themed—much like art and music at this time period—reflecting the chaos incurred during this war (Banes, 1998). Around the time of the feminist movement and women's suffrage, modern dance seemed to cover many feminist themes, while in the 1960s there

was more inclusion of males in modern dance practice (Banes, 1998). Generally modern dance contains themes of rebellion against social norms, and, thus, the very nature of this genre is to reflect cultural themes pervasive in contemporary society.

Comparison of modern and ballet dance. Due to the nature of modern dance being a reflection of and a rebellion against society and social norms, modern dancers' bodies are typically distinctive from ballet dancers' bodies. Modern dancers usually have BMIs in the healthy range, averaging around 22 kg/m² (Angioi et al., 2009; Friesen et al., 2011; Swami & Harris, 2012). Reported body fat percentages for this population are also considered healthy, ranging from 20-26% body fat (Angioi et al., 2009; Friesen et al., 2011). Moreover, athleticism is a necessary skill component for modern dancers (Angioi et al., 2009). In a comparison of physical fitness with aesthetic skill in modern dance, higher scores were associated with better performances (Angioi et al., 2009).

When compared to ballet, modern dancers have higher BMI and body fat percentages. Ballet dancers have an average BMI and body fat percentage of 17-21 kg/m² and 16-19% (Swami & Harris, 2012; Twitchett et al., 2008; Yannakoulia et al., 2000). However, both ballet and modern dancers showed declines in BMI and body fat percentage with increased expertise in their respective genres (Angioi et al., 2009; Swami & Harris, 2012).

Modern dancers also had a higher incidence of eating disorders than match-paired nondancing counterparts, with a 12.9% rate of eating disorders in the modern dance group and a 0% rate of eating disorders in the non-dancing group (Friesen et al., 2011). This rate is lower than the rate of eating disorders found in ballet dancers by Nascimento (2012) and Weslin & Silva-Smith (2010), which were 17-24% in their dance populations.

This is still significantly higher than the general population, which has an eating disorder incidence around 2.7% (Nascimento et al., 2012; Qian et al., 2013; Weslin & Silva-Smith, 2010). However, modern dancers had higher scores of body appreciation when compared to paired ballet dancers (Swami & Harris, 2012). Modern dancers also had higher rates of menstrual dysfunction than match-paired nondancers, a finding noted in ballet dancers, as well (Burckhardt et al., 2011; Friesen et al., 2011; Doyle-Lucas et al., 2010).

A reason why modern dancers' bodies are different from ballet dancers' bodies pertains to the aesthetics of dance. For many years, before the development of modern dance, ballet emphasized thin frames; this aesthetic was reinforced by choreographer George Balanchine, the use of *pointe* shoes, and costuming (Banes, 1998; Laemmli, 2015; Lee, 1999; Ritenburg, 2010; Vincent, 1989). Relatively restrictive costumes are re-used by dancers; thus, the pressure to be small enough to continue to fit into one's costume is a driving force for thinness in ballet dancers (Vincent, 1989). Modern dance, on the other hand, is much more freeform and individualized, so costumes are customized for the dance and the dancer. Costumes also tend to be pedestrian and loose-fitting, with specialized costumes being made for individual dancers in specific dance pieces (Banes, 1998).

Modern dance is also focused on expression by the body, so the aesthetics are much less dependent on the body's form, as in ballet, and more related the uniqueness and movement patterns and phrasing. Clearly pressures have migrated from ballet into modern dance, as evidenced by the higher incidences of eating disorders and menstrual dysfunction seen in modern dancers, even considering the better body appreciation and

healthier weight profile modern dancers present. Therefore, modern dancers still exhibit risk for nutritional concerns.

Nutritional intake and its effects on dancers. Burckhardt et al. (2011) studied young ballet dancers, their dietary intake, and their bone mineral density. They found that dancers underconsumed all food groups, and those with the least dairy consumption had the lowest bone mineral density (Burckhardt et al., 2011). Doyle-Lucas et al. (2010) evaluated bone mineral density in elite professional ballet dancers compared to control nondancing, active women and found that the bone mineral density of the dancers did not significantly differ from the controls. However, when bone mineral density was compared to menstrual function, there was a decrease in bone mineral density with decreased menstrual function (Doyle-Lucas et al., 2010). Friesen et al. (2011) evaluated bone mineral density of collegiate modern dancers compared to matched, nondance controls and determined that the dancers had higher bone mineral densities than the controls, despite reporting higher rates of menstrual dysfunction and eating disorders. Friesen et al. (2011) suggested that the impact and mechanical stress on the bones of dancers can be enough to overcome the challenges of eating disorders and menstrual dysfunction. The dancers in Friesen's study had higher body weights than ballet dancers in similar studies, a factor that also contributes to higher bone mineral density.

Motivations Behind Dietary Choices

The strongest driving force behind the dietary choices of dancers is the presence of an ED or BDD. As previously discussed, these disorders have compulsive aspects that drive the choices of foods, food intake, and exercise. Extensive treatment with a health care team is necessary for recovery from an eating disorder, and relapse is common. In

dance, there is a likelihood of a disordered eating culture that can encourage the development of disordered eating (Sundgot-Borgen et al., 2013).

There are aesthetic aspects to dance that must be considered as motivation for dietary choices. Dance favors low waist-to-hip and waist-to-thigh ratios, ectomorphy, and low body fat for a slim, lithe figure (Koutedakis & Jamurtas, 2004; Russell, 2013; Twitchett et al., 2009; Weslin & Silva-Smith, 2010). On average, Koutedakis & Jamurtas (2004) stated that female ballet dancers have a body fat percentage of 16-18%, which is low for females (Koutedakis & Jamurtas, 2004; Twitchett et al., 2009). This is generalized for all dance, but with a focus on ballet in particular. Ectomorphy is characterized by a willowly, lean, long body shape without large amounts of muscle tone. For some, this is a natural body shape, but for many dancers, this body type is only obtainable though dieting. Dieting is not typically paired with exercise outside of dance practice due to the "fear" of the development of muscle tone or hypertrophy for aesthetic purposes (Koutedakis & Jamurtas, 2004; Russell, 2013; Twitchett et al., 2009).

Perfectionism, a personality trait that drives individuals to be the best in their area of interest, is prevalent in dance culture. It is common in people diagnosed with eating disorders, so much so that it is considered a risk factor (Penniment & Egan, 2012). Penniment and Egan (2012) investigated the connection between perfectionim and eating disorders, with the theory that "thinness-related learning" was a mediating factor. Although they found a positive correlation between perfectionism, thinness-related learning, and eating disorders, they were not able to determine causation. Perfectionism traits may allow dancers to progress to higher levels of dance, which would allow them to be exposed to more "thinness-related learning" (Penniment & Egan, 2012). Thinness-

related learning is defined by Annus and Smith (2009) as "expectations that being thin or restricting food intake will lead to reinforcement such as. . . becoming more attractive" (p. 50). More thinness-related learning exposure was positively correlated with ED development. Perfectionism and thinness-related learning most likely cause a spiral towards ED development. Competitiveness is closely related to perfectionsim and is also a driving force for eating behaviors. Competitiveness of a dancer to be better than their peers, especially if it comes to aesthetic qualities, can influence the likelihood of using dieting to achieve their goals (Weslin & Silva-Smith, 2010). This is also seen in sports where weight has a direct influence on performance, such as jockeying, ski-jumping, running sports, and cycling (Nattiv et al., 2007; Thomas et al., 2016). There are numerous motivations that can drive the dietary choices of dancers, all of which are drawn to the same result: better performance.

Dietary Characteristics of Dancers

Dancers are considered a high-risk population for ED. Therefore, studies have been done to evaluate the trends in dietary intake for this population with a focus on overall energy intake as well as the intake of specific vitamins and minerals, mainly calcium and vitamin D. These nutrients are of special interest due to their relation to bone health, as previously stated (Sangenis et al., 2005; Thomas et al., 2016). In their study on the energetic efficiency, menstrual irregularity, and bone mineral density of professional ballet dancers, Doyle-Lucas et al. (2010), analyzed 4-day food logs of dancers as well as pair-matched nondancing controls. Compared to their pair-matched controls, the dancers ate 500 kcal less and had higher levels of physical activity. There

was no difference between the two groups in the ratio of macronutrients consumed, both were within the recommended ranges (Doyle-Lucas et al., 2010).

The study also evaluated the risk of eating disorders using the Three Factor Eating Questionnaire (TFEQ) and the Eating Attitudes Test-26 Score (EAT-26). Dancers with higher dietary restraint scores on the TFEQ as well as higher scores on the EAT-26 have an elevated risk of disordered eating (Doyle-Lucas et al., 2010). The dancers reported greater menstrual irregularities (6 of the 15 subjects) compared to the controls (1 of the 15 subjects) (Doyle-Lucas et al., 2010). While bone mineral density for both groups were not significantly different, the values for both groups were below average for their age and sex (Doyle-Lucas et al., 2010).

Burckhardt et al. (2011) looked at younger dancers than Doyle-Lucas et al. (2010) and the effects of nutrition on puberty and bone mineral density. Subjects were 15-18 years old, preprofessional ballet dancers that completed 3-day food logs. This study was different from other studies measuring food intake because actual energy intake was not measured; instead, foods were broken into servings of food groups and measured by the amount of servings of each food group the subject ate. This method made it easy for the young participants to complete accurately, but creates difficulty when comparing this study to other studies. Nonetheless, it provides insight into the types of foods eaten by the participants (Burckhardt et al., 2011).

Dancers consumed slightly inadequate amounts of fruits and vegetables, had very low dairy intake, and excessive protein intake when compared to Sweden's nutritional guidelines for the food groups, which do not differ significantly from the United States' MyPlate guidelines (Burckhardt et al., 2011). The dancers also had low

bone mineral densities; their average BMI was in the healthy range, albeit at the bottom of the range (Burckhardt et al., 2011). Low intake of dairy, fruits, and vegetables suggest a possible inadequate intake of calcium and vitamin D as well as many other micronutrients, since many dairy products are fortified with vitamin D. The work by Doyle-Lucas et al. (2010) and Burckhardt et al. (2011) both agree with other literature (Koutedakis & Jamurtas, 2004; Twitchett et al., 2009; Weslin & Silva-Smith, 2010), stating that dancers typically have low energy intakes with insufficient intake of calcium and vitamin D, making them at high risk of the Triad.

Dietary Characteristics of Modern Dancers

Few studies have examined nutritional issues specific to college, nonballet dancers; most studies on dancers generalize over all genres of dance, or focus on ballet (Burckhardt et al., 2011; Doyle-Lucas et al., 2010; Doyle-Lucas & Davy, 2011; Koutedakis & Jamurtas, 2004; Nascimento et al., 2012; Penniment & Egan, 2012; Twitchett et al., 2008, 2009; Weslin & Silva-Smith, 2010; Yannakoulia et al., 2000). There also is little research on university dancers specifically; most studies done are either on preprofessional dancers, which can encompass any age prepubescent up to college, or professional dancers (Burckhardt et al., 2011; Doyle-Lucas et al., 2010; Doyle-Lucas & Davy, 2011; Nascimento et al., 2012; Twitchett et al., 2009). A study by Twitchett et al. (2009) compared professional and university dancers, but only examined fitness and VO2max, not dietary aspects. There is a dearth of research dealing directly with motivations behind dietary choices. Most studies examining dietary habits investigated ED, BDD, perfectionism, etc. (Hincapié & Cassidy, 2010; Liu et al., 2016;

Nascimento et al., 2012; Penniment & Egan, 2012) rather than motivational reasons for dietary choices.

Given the differences in environment, time constraints, and goals, university dancers may have very different dietary patterns and issues, as well as motivations for their dietary choices. University dancers are not all ballet dancers, providing more differences to be dealt with in a health care setting. This population should be studied to provide a better understanding of their needs and issues, in order to generate better ways to help this population by health care professionals. Therefore, the purpose of the present study was to analzye modern dancers at Ohio University to determine the adequacy of their diets, and to find themes in motivations behind their dietary choices in order to understand this population better and to provide guidelines for better, more specific nutritional care.

Chapter 3: Methods

Participants

Methodology for this study was approved by the Institutional Research Board prior to participant recruitment. Thirteen female participants volunteered to participate following recruitment using flyers and e-mails through the Ohio University Dance Division. One participant was excluded from the study because of a high score on the SCOFF questionnaire. A copy of the recruitment flyer and email are provided in Appendix A. Recruitment flyers will be placed in Putnam Hall, where the dance studios are located. E-mails were sent to students by the Director of the Dance Division. Inclusion and exclusion criteria are listed below in Table 2.

Table 2

Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Between ages 18 and 30 years.	Precluded from dancing due to injury lasting longer than one month.
Currently an enrolled dance major or minor at Ohio University.	Pregnant or lactating.
Five years of dance experience prior to entering Ohio University.	Pursuing a major or minor in nutrition, dietetics, exercise physiology, or athletic training.
	Younger than 18 years old, or older than 30 years old.
	Currently under treatment for an eating disorder.

Following screening for inclusion and exclusion criteria, qualifying participants gave their informed consent to participate in the study prior to data collection. A copy of the consent form is provided in Appendix B.

Data Collection

Questionnaire. Participants completed a questionnaire. This questionnaire gathered information on the participants' demographics, years of dance experience, and types of dance participation. The 5-question SCOFF screening tool for eating disorders was included to screen for participants who exhibit high-risk of eating disorder behaviors. A score of 2 or more on the SCOFF questionnaire indicates disordered eating or an eating disorder. If a participant scored a 2 or above on the SCOFF questionnaire they were not included the study. A copy of the questionnaire is provided in Appendix C.

Anthropometric measurements. Height and weight were measured after completion of the questionnaire. Shoes and clothing other than standard dancewear were removed before measuring weight and height. Height was measured with a stadiometer to the nearest half inch (400KL, Healthometer, Bridgeview, IL). Weight was measured using a digital scale (seca703, Seca, Chino, CA) with the subject facing backwards to prevent subjects from seeing their weight if desired. Waist circumference was measured using a flexible measuring tape positioned at the waist of the participant. Estimated energy requirements (EER) were calculated from height, weight, and age. Body mass index (BMI) was calculated using the measured height and weight. A copy of the data collection form for anthropometrics is provided in Appendix D.

24-hour food recall. The participant completed a 24-hour food recall with the investigator. The participant was asked to recall everything that they consumed within the last 24 hours or a typical day for the participant. They were asked to specify approximate amounts and preparation of the food when applicable. The data was to be used along with food logs that the participant recorded and allowed the participant to talk about the foods they ate and when they ate directly with the investigator, and also served as a backup method of obtaining information on food intake in case the participant did not return their food logs, which occurred with one participant. This method was used exclusively to collect food intake data due to issues with the food logs and pictures as stated below.

Interview. Participants were interviewed after the questionnaire, anthropometrics, and the 24-hour food recall were collected. The interviews were semistructured and asked questions relating to the motivations behind their current diet, nutritional information sources used by the participants, characteristics of their "ideal" diet, and any barriers to attaining proper nutrition experienced by the participant. Interview questions that were used are listed in Table 3. This interview was audio recorded and the investigator took notes during the interview. The interview was transcribed by a third-party transcriptionist to prevent biases during transcription.

Table 3

Interview Questions

Question	Follow-up Questions
Please describe your dance experience.	• What age did you start dancing? • What got you into dancing? • What genres have you practiced? • Which genre(s) do you identify as your main form?
In a typical week, how much time do you spend dancing?	• How many hours per week to you dance? • Do you participate in other forms of physical activity? Please explain. • How many hours per week to you dance?
Please describe your typical daily eating patterns	• How many meals do you eat a day, or do you not eat defined meals and graze throughout the day? • Are there times during the day you eat more? • Do you eat with other people, or by yourself mostly?
Are there foods you avoid for reasons other than allergies or medical conditions? If so, why?	
Do you have any food or personal goals that relate to your food habits or consumption? If so, what are they and why?	
Is there anything that prevents you from eating how you would like? How and why?	
Do you have any pressures that cause you to change how you eat from how you would like to eat? If so, what are they and why?	

Table 3 continued

What role does food play in your life?	
Is there anything that you would like to talk about that was not covered by the previous questions?	
Do you have any closing comments or questions for the researcher about this study?	

Food log. After completion of the initial meeting, participants completed a 3-day food log of 2 weekdays and 1 weekend day. Participants were instructed how to properly log their food intake to ensure maximum accuracy and compliance. They were given food log sheets on which to track their food intake. Food logs and instruction sheets were provided with permission by the Ohio University Diabetes Institute. Participants were also instructed to take digital photographs using their cellphones or digital cameras of everything they eat before and after eating to improve accuracy of food logs (Lagowska et al., 2014). These pictures were given to the investigator with the food logs. An example food log was also given to aid participants in completion of their food logs. Following completion of their food logs, they returned their logs and their pictures to the investigator for analysis. All materials provided to the participants are included in Appendix E. Not all participants completed and turned in food logs, and multiple participants did not include a complete set of pictures to accompany their food logs, so all food log and picture data were not used to stay consistent with intake analysis.

Data analysis. Descriptive statistics were computed for the background and food log data. All analyses were performed in SPSS statistical software version 21.0 (SPSS

Inc. Chicago, IL). Non-parametric *t*-tests were computed on food intake data to determine if the participants were reaching the RDA for all nutrients.

Data analysis in qualitative research is an iterative process, in which data collection and data analysis occur concurrently. For this study, the multidisciplinary research team debriefed after each interview to ensure the quality of the questions and interview techniques. Then, the research team performed content analysis by independently marking and categorizing key words, phrases, and texts to characterize the overarching themes. The research team met weekly to code the data; discrepancies were resolved through group consensus. The team analyzed each interview separately and then compared common themes across groups using NVivo 10 software (QSR International, Victoria, Australia).

Chapter 4: Results

Demographics

Participants were between the ages of 19 and 25 years (mean = 20 ± 1 years). All had previous dance experience of over a decade in various genres, with all participants practicing modern dance, and over half of them practicing ballet, jazz and tap. Contemporary was next with 41.7% and then African at 33.3%. Acrobatics, composition, Latin, lyrical, and praise dance were the least practiced at 8.3% of participants reporting experience dancing these genres.

The average height of participants was 157.7 ± 6.4 cm and weight was 59.0 ± 9.8 kg, with a BMI of 23.5 ± 2.7 kg/m². Participants spent 23 ± 10 hr a week in physical activity, which included time spent dancing per week (16 ± 8 hr) and recreational exercise (7 ± 5 hr). Average Estimated Energy Requirements (EERs) per day was 1693.4 ± 134.9 kcal. Table 4 contains demographic information for participants and Table 5 contains information on the genres practiced by participants.

Table 6 breaks down the employment of participants. The majority of participants were employed, at 75.0%. Three of the 12 (25.0%) participants were employed in a position related to dance or fitness. The rest were employed in a food-related or miscellaneous job.

Table 7 contains eating disorder screening tool results. Only 1 participant scored above a 1 on the eating disorder screening tool, indicating an elevated risk of DE/ED and that participant was not included in the study. Three participants scored a 1, and 9 participants scored a 0. Scores of 0-1 indicate a very low risk of DE/ED.

Table 4

Demographics and Anthropometrics

	Mean ± *SD*
Age	20 ± 1
Years at OU	3 ± 1
Years of dance experience before OU	15 ± 2
Years of dance experience at OU	2 ± 1
Days per week dancing	6 ± 1
Hours per week dancing	16 ± 8
Days per week exercising	5 ± 2
Hours per week exercising	7 ± 5
Total physical activity per week (hr)	23 ± 10
Height (cm)	157.7 ± 6.4
Weight (kg)	59.0 ± 9.8
BMI (kg/m^2)	23.5 ± 2.7
Estimated EER (kcal)	1693.4 ± 134.9

Table 5

Frequency of Genres of Dance Practiced

Genre	Percentage of Sample Practicing
Modern	100.0
Ballet	83.3
Jazz	83.3
Tap	58.3
Contemporary	41.7
African	33.3
Hip Hop	16.7
Acrobatics	8.3
Composition	8.3
Latin	8.3
Lyrical	8.3
Praise	8.3

Table 6

Employment of Participants

Employment	Frequency	Percentage
None	3	25.0
Fitness-related	1	8.3
Food-related	2	16.7
Dance-related	1	8.3
Fitness and dance-related	1	8.3
Other	4	33.3

Table 7

Eating Disorder Screening Tool Scores

Score	Frequency	Percentage
.00	9	75.0
1.00	3	25.0

24-Hour Food Recall Analysis

Table 8 contains the average macronutrient intake of the participants compared to the DRI values for those nutrients while Table 9 contains the micronutrient intakes compared to the RDA. The percentage of participants that met the RDA (intake of 75-125% of RDA value) are listed. A nonparametric one-sample *t*-test was used to determine significance with $p \leq 0.05$ of each micronutrient compared to its RDA value. On average, participants met all the recommendations for macronutrients. Total fat intake met the upper-most recommended value at 35% while carbohydrate and protein

were within the recommended ranges. Saturated fat intake was slightly higher than recommended at 10.7% of total kcal. Analysis of micronutrient intake found that many participants did not meet the RDAs. Intakes of sodium, niacin, fluoride, and manganese were significantly higher than the RDA. Intakes of zinc, iron, vitamin D, vitamin E, vitamin K, chloride, copper, and chromium were significantly lower than the RDA. The remaining the micronutrient intakes were not found to differ from the RDAs significantly, though less than half of participants met the RDAs for all of them except for fiber, which had 75% of participants meeting the RDA.

Table 8

Macronutrient Intake

Nutrient	DRI	Mean ± SD	Percentage of Total Calories
Energy (kcal)	1693.4	1705.0 ± 601.6	
Carbohydrate (g)	45-65%	211.2 ± 93.6	49.5
Protein (g)	10-35%	72.5 ± 22.4	17.0
Fat (g)	20-35%	66.3 ± 38.8	35.0
Saturated fat (g)	< 10%	20.2 ± 12.1	10.7

Table 9

Food Log Analysis

Nutrient	RDA	Mean Intake ± *SD*	Percentage of Participants Who Met RDA	*p*-Value
Biotin (µg)	14.0	23.2 ± 27.3	8.3	.695
Vitamin K (µg)	90.0	222.7 ± 329.2	16.7	1.0
Thiamin (mg)	1.1	1.0 ± 0.5	25.0	.556
Sodium (mg)	1500.0	2419.3 ± 901.1	33.0	.006
Vitamin A (µg)	700.0	934.9 ± 1024.1	33.3	.695
Niacin (mg)	1.1	24.9 ± 14.4	8.3	.002
Folate (µg)	400.0	408.9 ± 397.4	16.7	.239
Vitamin B12 (µg)	2.4	4.2 ± 4.3	16.7	.308
Magnesium (mg)	310.0	259.5 ± 196.0	41.7	.117
Zinc (mg)	8.0	4.9 ± 3.1	25.0	.012
Fiber (g)	25.0	24.4 ± 16.0	75.0	0.10
Vitamin C (mg)	75.0	191.9 ±183.4	16.7	.071
Calcium (mg)	1000.0	791.5 ± 387.3	16.7	.158
Iron (mg)	18.0	13.7 ± 5.1	33.3	.034
Vitamin D (µg)	5.0	2.3 ± 1.7	0.0	.004
Vitamin E (mg)	15.0	6.0 ± 5.3	8.3	.003
Riboflavin (mg)	1.1	1.3 ± 0.6	58.3	.346
Potassium (mg)	4700.0	2239.9 ± 1337.8	8.3	.003
Chloride (mg)	2300.0	18.1 ± 28.4	0.0	.002

Table 9 continued

Copper (µg)	900.0	0.9 ± 0.6	33.3	.002
Selenium (µg)	55.0	58.6 ± 41.1	25.0	.875
Fluoride (mg)	3.0	1325.8 ± 1526.0	8.3	.003
Manganese (µg)	1.8	3.0 ± 1.9	16.7	.041
Chromium (µg)	25.0	0.1 ± 0.1	16.7	.002

Qualitative Interview

Participants started dancing around age 3; average duration of before attending Ohio University was 15 ± 2 years. Two participants started later, with the oldest at 7 years of age. Eleven participants reported their reason for starting dance class was either because their parents placed them in dance as an afterschool activity or because they had a family member who was a dancer and that inspired their parents to enroll them in dance class. “My older cousin was a professional ballet dancer so I used to dance around with her and I think my mom wanted me to do the same thing.”

All participants stated that their love and enjoyment of dance lead to their desire to make it their career. “I just enjoyed it; I’ve never been able to quite describe why I still dance. . . I enjoy the release and the physical activity it gives me.” All participants studied a number of genres besides modern dance, including ballet, jazz, tap, pointe, contemporary, African, praise, hip hop, and lyrical. All but one participant stated that they had most their dance training in classical ballet before attending Ohio University, with three reporting that they attended a school specific to ballet and the performing arts before college. “Growing up, a lot of my time was spent at a really serious ballet school.”

All participants stated that their current, main genre of dance is modern, which is the primary form of dance at Ohio University.

Participants spent varying amounts of time in dance class and rehearsal. The average time spent dancing per week was 16 ± 8 hr, but ranged between 7-35 hr. “I would say between 15 and 20 hours [of dance per week].” There was no apparent trend between the hours spent dancing and the year the participant was in; the main factor was the amount of dance classes the participant was taking at the time and their participation in a performance that required rehearsal outside of class. “I’ve had days where I’ve had 5-6 hours of rehearsals.” All participants reported recreational exercise outside of dance. The majority (11 of 12) stated they ran or did various forms of cardiovascular exercise with three citing that they lift weights. Two participants worked as Pilates instructors and taught classes which counted towards their reported exercise outside of dance. “I’m a certified Pilates instructor. . . I teach a Pilates class twice a week.” Average time spent in physical activity outside of dance was 23.08 hr, more time than they spent dancing each week.

There were three main themes identified from the interviews: barriers to eating healthy, motivated to eat healthy, and perceived social pressures regarding food and eating.

The first theme, barriers to eating healthy, was the most prominent and included time, money, availability, and eating alone. Eleven participants stated that their eating schedule was based around their classes, with more defined meals in the morning before class or in the evening after classes. “Breakfast usually before dance, then I go to dance and after dance I’ll have lunch, then I usually have another dance class or course and then

I'll snack throughout the rest of the day until I go to bed." Snacking was common in many participants; 8 stated that they would snack between classes instead of having an afternoon meal. "Lunch is usually in class so a lot of us in that one class, it's a lecture class, eat at that time." Those with rehearsals stated that they ate when they had time, and had less defined meals than those who did not have rehearsals in the evenings. "Big breakfast, then lighter throughout the day, mostly just smaller meals and lots of snacks and little things to keep me going." Class time and the number of classes dictated when they ate with others, with nine dancers stating that they ate alone, even when they had roommates. During class or shared break times were the most commonly cited times that participants ate with others. "By myself mostly, occasionally I eat with other people but we're all super busy and class schedules are different." Lack of time was cited as the reason for eating patterns, why they ate alone, and a major barrier against the purchase and preparation of food. "Most of the time I don't even make it to Walmart, maybe once or twice a month." Money was also a barrier for participants because some participants found it difficult to buy "healthy food" occasionally. Availability of food was also a major factor in the participants' food choices, with one participant stating that the local restaurants did not offer many affordable, healthy options. "Athens is not conducive to eating healthy on the go unless you pack something." Overall, time and money were the two biggest factors affecting food choice and the timing of meals cited by participants.

"Motivated to eat healthy" was the second theme identified. There was an overall emphasis on healthfulness and considering food as "fuel." "[Food] is definitely energy to get me through all my activities during the day." Eight participants, when asked what role food played in their life, answered that food was a source of energy or fuel to help them

get through the day and allow them to dance and function. Most (10 of 12) participants stated that they wanted to "eat healthy" when talking about their personal food-related goals. This desire to eat healthily affected their food choices by influencing them to avoid certain foods and to watch portions. Multiple participants (4 of 12) mentioned avoiding carbohydrates or high-fat foods. "I don't like a lot of foods with high cholesterol and high fat content." A few (3 of 12) participants mentioned avoiding sugar and "junk" or "processed" foods. A couple participants (2 of 12) were vegetarian or vegan and that affected their food choices.

Many (6 of 12) participants stated that they did not wish to gain weight as a reason for eating healthy, as well as to keep them dancing at their best and feeling their best. "I've been trying to watch my weight so I've been staying away from junk food and things you're typically not supposed to eat." Despite weight-related concerns, 3 participants explicitly stated how "body positive" the dance program is at Ohio University, especially those participants with a strong ballet background. One stated that the program was extremely accepting of all body shapes and sizes and there was no shaming or critiques of weight or shape. All messages coming from the professors about food were to emphasize the need to properly fuel and eat for better performance. "Here, you have to be healthy and different body types are encouraged and that's typical of the modern dance community, while in ballet, you're trying to fit into a certain mold." Another participant with a strong ballet background mentioned her experience at a ballet school. She experienced weigh-ins and a culture that perpetuated dieting and not eating when it came to performances and auditioning "I came from a classical ballet school

where we had weigh-ins. . . they stopped doing that but it's definitely something that we shouldn't have been thinking about."

The last theme was the perceived social pressures regarding food and eating. Despite the "body positive" message reported, some (6 of 12) mentioned that they experience social pressures to eat a certain way or to look a certain way. One participant reported some dancers not eating before performances. "The day of the performance, girls will would say 'I won't eat so I look good in my costume.'" Another stated that when she ate with others, she felt pressured to eat less than usual and "healthier" than when eating alone because she felt like she would be judged as "fat" if she did otherwise. "I've had the thought of if I have something on my plate that's not healthy, people are going to be like 'oh, she's fat' and I hate that thought." There also was awareness of body size with a few dancers, with one stating that she was "bigger than the other dancers" and that that was often on her mind. "I am bigger than the other dancers so it's definitely always in my head." Another felt that she had to "look good" for everyone else because she was a dancer. "I think it's always in the back of my mind that I have to look good because I have to look good for everyone else." Overall there was the message that even though some felt pressured to look or eat a certain way, there was an emphasis on healthiness as the driving force behind dietary choices.

Chapter 5: Discussion

The purpose of my study was to analyze modern dancers at Ohio University to determine the adequacy of their diets, and to find themes in motivations behind their dietary choices in order to understand this population better and to provide guidelines for better, more specific nutritional care. Twenty-four hour food recalls, and semistructured interviews were used to measure food intake and motivations for dietary habits.

Anthropometrics

The average weight and BMI of participants were 59.0 ± 9.8 kg and 23.5 ± 2.7 kg/m², respectively. This BMI value falls inside the healthy range of 19-24.9 kg/m² (Brooks et al., 2005), indicating that the participants were overall at a healthy weight. This was expected based on other studies done with modern dancers; the average BMI for modern dancers in other studies has been around 22 kg/m² (Angioi et al., 2009; Friesen et al., 2011; Swami & Harris, 2012). The BMI recorded from the subjects of the present study was higher than that reported in studies done with ballet dancers, which range from 17-21 kg/m² (Swami & Harris, 2012; Twitchett et al., 2008; Yannakoulia et al., 2000).

Physical Activity

Physical activity is an important factor in determining caloric needs, and the amount of time spent in physical activity in this sample was unusually high. Participants reported exercising outside of dance, with 7 ± 5 hr on average per week spent on physical activity unrelated to dancing. A few dancers mentioned specifically that they weight-trained, with a few being Pilates instructors and some doing various forms of cardiovascular exercise. This finding was not expected because most studies looking at physical activity and dancers found that very few dancers exercised outside of dance

(Koutedakis & Jamurtas, 2004; Russell, 2013; Twitchett et al., 2009). These studies determined that the dancers did not participate in exercise outside of dance because of the perception that it would lead to an undesirable, muscular frame (Koutedakis & Jamurtas, 2004; Russell, 2013; Twitchett et al., 2009). A study on the physical fitness of modern and ballet dancers showed that modern dancers scored higher on fitness tests than the ballet dancers (Angioi et al., 2009). The results of the study suggest that modern dance is more varied and incorporates many more movements than ballet, thus requiring more fitness to perform (Angioi et al., 2009). Based on the results of the present study, fitness of modern dancers could be higher because they are likely to participate in other forms of physical activity outside of dance.

Eating Disorder Screening Tool

The SCOFF questionnaire was used to exclude participants that were at high risk of disordered eating and to evaluate the overall perception of food in this sample. One participant scored a 1 on the SCOFF eating disorder screening tool and 9 scored a zero, indicating a low risk of eating disorder behavior in this sample. One participant had to be excluded from the study for scoring a 3 on this screening tool. In previous studies, ballet dancers had higher scores on eating disorder tools (Liu et al., 2015; Nascimento et al., 2012; Weslin & Silva-Smith, 2010). Participants who had a strong ballet backgrounds reported weigh-ins and an emphasis on looking a specific way or needing to lose weight when they were at their ballet studio or school (Liu et al., 2015; Nascimento et al., 2012; Weslin & Silva-Smith, 2010). The low scores align with statements made about “body positivity” within the Ohio University dance department by the participants during their interviews, showing a trend towards healthy outlooks on eating behaviors. Overall, this

sample showed a low risk of disordered eating and this could be, in part, due to the overall positive attitude towards food and eating that the dance department exhibits to its students.

Food Intake

Twenty-four hour food recalls were used to measure food intake in participants and these values were compared to DRI and RDA values for this population's age and sex (19-30, female). Zinc, iron, vitamin D, vitamin E, potassium, chloride, copper, and chromium were all consumed at levels below recommended. This does not support my hypothesis that total kilocalories and fat would be under-consumed. Under-consumption of iron is common in women (National Institutes of Health, 2016) and over time could result in fatigue and microcytic anemia, both of which can impair a dancer's ability to practice and perform (National Institutes of Health, 2016) Under-consumption of vitamin D is of interest, as well, because of its relationship to calcium absorption and maintaining calcium in the bone to prevent osteoporosis. While vitamin D was under-consumed by the participants, this study did not ask any questions regarding exposure to sunlight or time outside nor were serum vitamin D levels measured. It is not known whether vitamin D deficiency was present in this sample. Constantini, Arieli, Chodick, and Dubnov-Raz (2010) looked at dancers and other athletes and found that dancers were highly likely to have vitamin D deficiencies due to their low iron intake and their extended time spent indoors. This means that it is likely that there could be a deficiency in this sample. However, data collection took place during late spring/early summer and it is possible that participants spent enough time outside with enough exposed skin to have the benefit

of vitamin D creation through sun exposure. Therefore, conclusions cannot be drawn about serum vitamin D status.

Energy intake in this sample met the average EER calculated for this sample, which was not expected. It was hypothesized that energy intake would be below recommended. This sample was also at a healthy weight on average and scored low on the SCOFF questionnaire except one which suggests that this population may be at a low risk of disordered eating. However, this was a small sample and participants self-selected to participate in this study, so these results may not represent the whole population and more data needs to be collected. It was hypothesized that the participants would under-consume total fat. However, participants were consuming fat within the recommended range, but was at the very top of the range at 35% of total calories. This could be because some participants mentioned eating a diet lower in carbohydrates, and they may perceive a low carbohydrate diet to be healthy. Saturated fat intake was slightly above the recommended amount of less than 10% of total calories. High intake of saturated fat over time could lead to high cholesterol levels and heart disease (Otten et al., 2006). This population is young, female, and active so with their intake being just over 10% of total calories, they are still at a low risk of developing these issues right now. Overall, fat intake was higher than hypothesized and there was a higher consumption of saturated fat than recommended.

The adequate energy intake found in the participants did not agree with the previous studies by Doyle-Lucas et al. (2010) and Burckhardt et al. (2011), both of which also found low energy intake in their dance populations. Doyle-Lucas et al. (2010) found that all macronutrients in their dancer sample were within recommended ranges, with fat

being at the low end of that range while calcium intake recommendations were reached and exceeded. However, Burckhardt et al. (2011) found that all food groups were under-consumed excepting nondairy proteins, which indicates that energy and calcium was most likely under-consumed and protein was most likely over consumed, but fat and carbohydrate intake are unclear due to their methods of dietary data collection. They collected dietary data through the amount of food groups consumed, not specific foods. The only study that showed over-consumption of fat was in elite figure skaters; their fat intake was slightly above the recommended range. The figure skaters studied by Ziegler et al. (2001) were below recommended intakes in energy and calcium unlike the sample in this study, making this sample different from ballet and figure skaters. This is to be expected because modern dance is very dissimilar to both ballet and figure skating in style, movements, and aesthetics.

Interviews

The most surprising finding to come from the interviews was the theme of "motivated to eat healthy" and the emphasis the dance department faculty placed on "body positivity." Most research done on ballet highlights the emphasis on low body weight and fat perpetuated by the instructors of the genre (Burckhardt et al., 2011; Doyle-Lucas et. al., 2010; Swami & Harris, 2012; Twitchett et al., 2008; Yannakoulia et al., 2000). Although modern dancers overall do have more acceptance of and satisfaction with varied body types, more experienced modern dancers have lower weights and body fat (Angioi et al., 2009; Swami & Harris, 2012). This decline could be due to the longer duration of their practice, which over time would increase muscle mass and lower weight due to the physical activity involved rather than because of social pressures to lower

weight. It has been suggested that modern dance does increase physical fitness more so than ballet dance, possibly due to its greater variation in movements compared to ballet (Angioi et al., 2009). When asked what the role of food was in their life, several dancers in this sample stated that food was a source of energy or fuel for them. They viewed food as a means for them to be able to practice and have the energy to make it through the day. This positive relationship with food is vital in reducing the risk of eating disorder behaviors. Some did mention that food was enjoyable or a comfort, which is a more typical response and not unhealthy when paired with a low score on the ED screening tool, which they were. Therefore, this viewpoint on food that the dancers reported seems related to their low scores on the ED screening tool. Most participants also mentioned a desire to eat healthily, which drove their eating behaviors, more so than a desire to lose weight.

When examining dietary intakes, however, participants exhibited substantial room for improvement. One likely reason is the theme of barriers that was presented. The barriers most cited were time, money, availability, and eating alone. Inability to purchase food due to lack of time or lack of money could prevent some participants from being able to eat a balanced diet. These factors also could result in purchasing convenience foods that may not fit into a balanced, nutritious diet. Many participants reported eating some type of restaurant or take-out meal once or more in their food logs, thus supporting this theory. The majority of participants had part-time jobs while completing their education, which further supports the reasoning behind why participants reported a lack of time to put towards purchasing, preparing, and eating their food. These findings suggest that the main motivations for the diets these dancers consume are firstly health,

followed by the availability of food, money to purchase food, and time to purchase and prepare food.

Most participants reported eating alone rather than with others. Eating alone has been shown to change the amount of food eaten and the duration of eating by subjects (Bell & Pliner, 2003; de Castro & Brewer, 1992). de Castro and Brewer (1992) found that when people ate in groups, they ate significantly more than when eating alone. Bell and Pliner (2003) observed that, as eating in groups increased, the duration of the meal increased, but were unable to measure the amount of food eaten over the duration of the meal. They studied three eating settings, a workplace cafeteria, a moderately-priced restaurant, and a fast-food establishment and found that the cafeteria and fast-food establishment had similar results, particularly for the sole-eater groups (Bell & Pliner, 2003). They hypothesized that this was because eating alone was associated with a negative stigma so sole-eaters ate quickly to avoid this stigma. They also hypothesized that sole-eating at these areas was more common than the moderately-priced restaurant because the sole-eater could eat quicker (thus avoiding the stigma) and also because they may have needed to go back to work quickly so didn't have the time to have a longer meal period (Bell & Pliner, 2003). The participants in this study who reported eating alone often cited time as a reason to not eat with others; they had short periods of time to eat and differing class schedules made it difficult to eat with others. Other participants stated that they ate differently with others, with one subject saying she would eat differently and more with others than she would when she was alone. Therefore, these participants' dietary habits are based mostly on eating alone and analyzed assuming the participant was eating alone. The participants were not asked if they ate each reported

meal alone or with one or more people; however, most participants stated they ate alone most of the time so it can be assumed that the majority of food consumed was done alone.

Another reason for the discrepancy between the desire to eat healthily and actual intake could be a lack of formal education in nutrition. Participants were not asked if they had taken a course on nutrition. It is not a required course, but it is an option as a tier 3 science course. Therefore, nutrition education among our sample of dancers could vary widely. It could be postulated that participants are attempting to eat healthily based on information that they acquire from sources such as peers, family, social media, and popular media such as television and websites. Information from these sources is potentially misleading, incorrect, or only partially correct, resulting in a diet not that is completely balanced as observed in this study. The inclusion of questions asking where participants get their nutritional information should be considered in future studies to evaluate their methods of obtaining information. This sample seems receptive to education based on their overall desire for health, so more educational opportunities in nutrition probably would be successful.

Limitations

The greatest limitation to this study was the small sample size. The target population was very small, around 60 people maximum. Data were collected and analyzed by one researcher, so the sample size was also limited. The desired sample size was originally 20 participants, but only 12 eligible dancers volunteered. One subject was not included due to a high SCOFF score.

There was selection bias in this study because our sample may have contained mostly or entirely participants interested in food and nutrition. Another limitation was

that the sample was drawn from a single medium-sized public university located in the Midwest United States. This population may not be comparable to other sizes and types of universities in different regions of the United States.

Dancers from only one genre of dance (modern/contemporary) were assessed, so these results may not transfer to other forms of dance. All data were self-reported, which may have introduced bias from the participants if they were not complete or honest in their answers.

The self-reported food logs did not include the mass of the food items. Food logs are documented to under-report intake (Dorgan et al., 1996), and although participants were asked to include pictures with their food logs to help with accuracy, many subjects either did not take pictures or did not have pictures for all of their food items. Many subjects reported they had difficulty remembering to take the pictures, which suggests that this method of improving accuracy may not be completely valid for this population. Subjects also expressed difficulty completing the food logs and returning them to the researcher, resulting in the food log and picture data to be thrown out due to the inconsistencies in completion.

Future Directions

Based on this study, there are a number of suggestions for further research on motivations for the dietary choices of university dancers. Using a larger sample size and including dancers from several universities would greatly improve the information gathered and allow for better generalizability across university dancers. Incorporating other genres of dance would help determine differences in nutritional practices among genres. Removing the photography requirement from the food logs may also improve the

speed of return of the food logs and lessen the burden on the subjects, thus improving data collection and accuracy. Menstrual history should also be included in the demographic questionnaire to better judge the risk of amenorrhea and provide a more complete history of health of the subjects. Using a control group of collegiate, nondancing females would be useful in determining if the results are unique to collegiate female dancers or to collegiate females in general and should be considered in the future. As mentioned previously, including questions to gauge both nutritional knowledge and the sources of nutritional information would be necessary to better understand both what the participant thinks a healthy diet consists of as well as the quality of their information.

Conclusions

This study shows that modern, collegiate dancers have a desire to eat in a manner that is nutritious. Because their diet may not reflect their desire, nutritional treatment and counseling needs to consider this when dealing with this population. The modern dancers studied in this research tended to be heavier and more physically active than ballet and modern dancers that have been studied in the past. Based on their intakes, they were not consuming an adequate diet compared to the RDAs in the majority of nutrients. They reported consuming adequate amounts of total fat and inadequate amounts of zinc, iron, vitamin D, vitamin E, potassium, chloride, copper, and chromium. Fat intake was not as hypothesized; it was expected to be under-consumed. Nonetheless, the dancers exhibited a strong drive to eat healthily to maintain their ability to dance and exercise. They also expressed that they dance in an environment that promotes healthy body image and inclusivity. Because many of the participants had backgrounds in ballet, issues with DE/ED and body image may still be present; therefore, screening for these problems is

vital. Motivations for diet were determined to be mostly for health and energy, followed by availability of food, money to purchase food, and time to prepare and consume food. Overall this study suggests that university modern dancers desire to have a healthy diet, but need education about what a balanced diet is as well as how to prepare frugal, quick, and nutritious food. This population also does not share many of the dietary trends seen in studies of ballet dancers. Additional research is necessary to further explore dietary habits and nutritional health in this population.

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Appendix A: Consent Form

Ohio University Consent Form

Title of Research: Determination of motivations behind food choices of collegiate female dancers

Researchers: Alexa Farrar, Elizabeth Beverly, Jeff Russell

You are being asked to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your participation in this study. You should receive a copy of this document to take with you.

Explanation of Study

This study is being done because we want to understand your food choices and motivations behind food choices.

If you agree to participate, you will be asked to complete a short background form and a 3-day food log, with 2 of the 3 days being week days and 1 day being a weekend day. Then you will participate in an interview. We will ask you questions about your eating habits and motivations behind these behaviors. The interview will be audiotaped.

You are eligible to participate in this study if you are age 18-30 years old and currently enrolled as a dance major at Ohio University with 5 years of dance experience prior to entering Ohio University.
Completion of the 3-day food log will take approximately 30-60 minutes each day. Completion of the background form and interview will take approximately 60 minutes. Therefore, this study will take an estimated total of 4 hours to complete.

Risks and Discomforts

Risks or discomforts that you might experience are that the audiotaping may cause some discomfort and distraction. Alexa Farrar is trained in the interview process and will use her expertise to minimize any discomfort that may arise. You may withdraw from the study at any time for any reason. Such a decision will not adversely affect your standing as a student at Ohio University.

Benefits

This study is important to science/society because the information and insights derived from this study may improve the nutrition counseling provided to collegiate, non-ballet dancers by registered dietitians and doctors relating to dietary habits and health.

Confidentiality and Records

Records relating to your participation as a research subject will remain private. All of the information given by you will be labeled with a code number and not your name. The list linking your code number to your name will be destroyed at the completion of the study (August 2016). Also, your name will never appear on surveys, audio recordings or any information produced from this study. You will receive a copy of this consent form for your reference.

Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with the representatives of the Ohio University Institutional Review Board as part of their responsibility to oversee research.

Compensation

As compensation for your time/effort, you will receive a $15 gift card after the completion of the interview. In order to receive this compensation, you will need to provide your name and address. The study team keeps track of the compensation that was provided for the Ohio University Finance division's records. Because the $15 gift cards are paid through University funds, the names and addresses will be shared with the Office of Finance, but Finance will not know your individual responses.

Contact Information

If you have any questions regarding this study, please contact Alexa Farrar at af152109@ohio.edu.

If you have any questions regarding your rights as a research participant, please contact Chris Hayhow, Director of Research Compliance, at Ohio University, (740) 593-0664.

By signing below, you are agreeing that:

- you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered
- you have been informed of potential risks and they have been explained to your satisfaction.
- you understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study
- you are 18 years of age or older
- your participation in this research is completely voluntary
- you may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you and you will not lose any benefits to which you are otherwise entitled.

Signature_____ Date_____

Printed Name_____

Appendix B: Recruitment Materials

Flyer

Are you a female age 18 years or older and enrolled as an undergraduate dance student at Ohio University?

You may be eligible to participate!

We are looking for dance major students to participate in a study about their dietary habits and food choices.

In this study you would help us by:

- **Completing a 3-day food log with pictures for each food for analysis**
- **Participating in a 30 to 40 minute interview about your food choices and motivations behind your choices**

For participating, you will receive a $15 gift card and your dietary analysis.

CONTACT US TODAY!
Alexa Farrar: af152109@ohio.edu

Recruitment Email

Dear Student:

Alexa Farrar, Dr. Elizabeth Beverly and Dr. Jeff Russell are studying modern dancers' food choices and motivations behind those choices. We invite you to participate in a 30-40 minute interview about your nutrition and nutrient intakes and motivations behind food choices.

The study involves a one-time meeting at a location of your choosing. Participation involves completion of a short background form, 3-day food log and interview. During the interview we will ask you questions about your food choices and motivations behind those choices. The interview will be audiotaped. The interview will last approximately 30 minutes.

Total participation in this study will last approximately 60-90 minutes. All information collected during this study will be coded in order to protect your privacy. Participants will receive a $15.00 gift card for their time and effort.

If you have any questions about the study or would like to participate, please contact Alexa Farrar at af152109@ohio.edu.

Sincerely,

Alexa Farrar, Dr. Elizabeth

Appendix C: Demographics Questionnaire

Background Information Questionnaire

Date of Birth: _____

Years at Ohio University: _____

Occupation (other than student) if applicable: _____

Current
Major(s):_____

Current Minor(s) if
applicable:_____

Years of dance experience prior to enrollment at Ohio
University:_____

Years of dance experience at Ohio
University:_____

Genre(s) of dance practiced/currently
practicing:_____

In a typical week, on how many days dance as part of your major or minor?
_____

In a typical week, approximately how many hours do you dance as part of your major or minor? _____

In a typical week, on how many days do you participate in a specific exercise session (such as such swimming, walking, biking) other than what you do as part of your dance major or minor? _____

In a typical week, approximately how many hours do you participate in specific exercise sessions other than what you do as part of your major or minor? _____

Are you currently pregnant or lactating? Yes No

Do you ever make yourself sick because you feel uncomfortably full? Yes/No

Do you ever worry that you have lost control over how much you eat? Yes/No

Have you recently lost more than fourteen pounds in a 3-month period? Yes/No

Do you believe yourself to be fat when others say you are too thin? Yes/No

Would you say that food dominates your life? Yes/No

Are you currently undergoing treatment for an eating disorder? Yes No

How would you describe your daily eating pattern?

3 main meals
Small meals eaten throughout the day
2 or less infrequent meals
Other: Please describe: _____

Appendix D: Anthropometric Data

Anthropometric Data

Height: _____
Weight: _____
Waist circumference:_____
Estimated RMR: _____
BMI: _____

Appendix E: Food Log Instructions and Food Log

Food Log Instructions

3-Day Food Record

Outline

- Overview
- Instructions
- Estimating Measurements
- Helpful Tips
- Examples
- Foods to Clarify
- Review
- Questions

Overview

- **What is 3-Day Food Record?**
  - Writing down everything you eat or drink over a 3 day period (usually two weekdays and one day over the weekend).
  - We are interested in your usual eating habits, so please don't change your diet.
- **What is a the purpose of a 3-Day Food Record?**
  - To better understand your dietary intake.

General Instructions

- **Do not start a 3-day food record if you are sick, as this may affect intake.**
- **Record everything you eat AND drink for 3 consecutive days.**
  - 2 weekdays and 1 weekend day
  - Option 1: Thursday, Friday, and Saturday
  - Option 2: Sunday, Monday, and Tuesday
- **Be as detailed and accurate as possible.**
- **Record all vitamins, minerals and supplements.**

General Instructions

- Be sure to take the food record with you so you can record intake immediately.
- If a homemade dish is eaten (i.e. casserole), try to include the recipe and the number of servings the recipe makes.
- Please provide food labels for any specialty foods (i.e. gluten free or other products for specialty diets)
- Don't forget to include foods/beverages consumed with medications.

Specific Instructions for Recording Foods

- For EVERYTHING you eat, record:
  - The *time* it was consumed
    - This is only necessary for the first food in each meal
  - The *type* of food
  - The *brand* name
  - A *detailed* description, including how the food was prepared (fried, baked, microwaved)
  - The *amount* consumed
  - Anything you *add* to the food (i.e. brown sugar on oatmeal, ketchup on french fries, etc)

Instructions for Recording Supplements

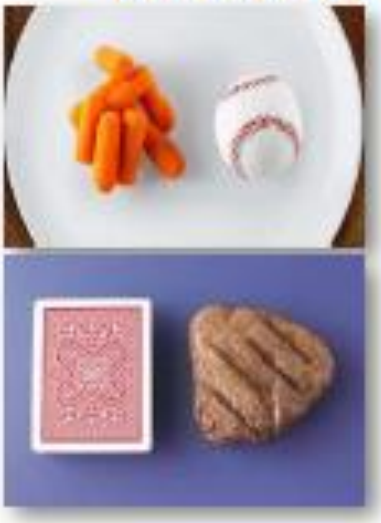
- **Record every supplement consumed with the following information:**
  - The *brand* name of the supplement
    - i.e. Kirkman's, Flinstone's
  - The *type* of supplement
    - Multivitamin, calcium, vitamin D, etc
  - The *quantity* of the supplement
    - i.e. ½, 1, 2
  - The *unit* of the supplement
    - i.e. tablet, gel cap, gummy, teaspoon
  - The *total dosage* of the supplement
    - i.e. if two 500mg tablets are taken, write "500mg x 2" in the description

Common Measurements

- **If possible, use measuring instruments (i.e. measuring cups, measuring spoons) when estimating your food intake**

- **If not possible to measure, estimate using the guides provided on the next slides**

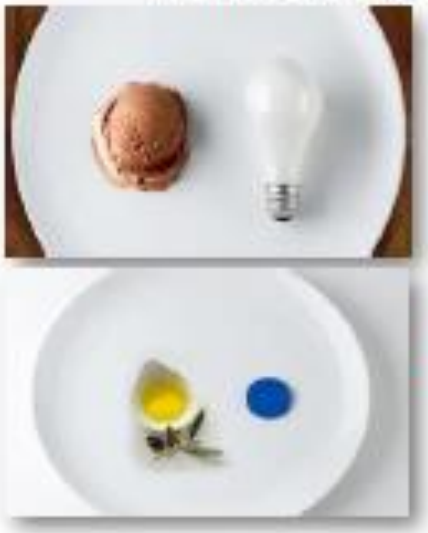
Estimating Measurements



1 cup = the size of a baseball

3 oz of meat = about the size of a deck of cards

Estimating Measurements



½ cup = the size of a light bulb

1 tsp oil = the size of a poker chip

Estimating Measurements

2 oz of cheese = the size of 4 dice

1 medium potato = the size of a computer mouse

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Estimating Measurements

2 Tbsp peanut butter = the size of a golf ball

1 small bagel = the size of a hockey puck

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Estimating Measurements

1 small orange or apple = the size of a tennis

Helpful Tips

- **It may be helpful to know how much your bowls and cups hold.**
  - Pour a typical serving in the bowl or cup, then measure that amount.
  - We recommend doing this before you start the 3 day food record.
- **Remember to record <u>everything</u> you drink, including water!**

Examples

Incorrect

Time	Food Item	Additional Description of Food/Beverage	Amount	Unit
7:30am	egg	scrambled	½	cup
	orange juice	Tropicana	1	glass
12:30pm	Hamburger	Kroger beef	1	patty
	Hamburger bun	white	1	bun
	Cheese	American	1	slice
	banana		1	piece
1:00pm	Vitamin C		1	pill

Examples

Correct

Time	Food Item	Additional Description of Food/Beverage	Amount	Unit
7:30am	egg	1 large brown egg, scrambled	½	cup
	milk	Kroger's – 1%	1	Tbsp
	margarine	Smart Balance buttery spread	1	Tbsp
	orange juice	Tropicana – fortified with Calcium and Vitamin D	6	oz
12:30pm	Hamburger	Kroger beef, 90% lean, grilled	3	oz
	Hamburger bun	Great Value, fortified white, ~3"	1	bun
	Ketchup	Heinz	2	tsp
	banana	Medium, ripe	1	piece
1:00pm	Vitamin C supplement	Nature Made, 500mg	1	tablet

Foods to Clarify

- **Milk**
  - Clarify % fat – skim, 1%, 2%, whole milks
- **Milk Alternatives**
  - Rice, almond or soy milk
  - Need the brand name and any additional information such as flavor, fortification, light, sweetened/unsweetened, etc
- **Butter/Margarine**
  - Need brand name and any additional information, such as if it was a "stick" or in a "tub"

Foods to Clarify

- **Fruit**
  - With or without skin – very important
  - Size – small, medium or large
- **Bagel**
  - Please be specific when recording bagels. If unsure of the size, please measure.
    - Small – 2-3¼"
    - Medium – 3 ½ - 4"
    - Large - >4¼"
- **Juice**
  - Fresh, from concentrate, from powder, etc
  - List the brand name and any additional information (such as flavor, fortification, enrichment, etc)

Review

- Be sure to have the record form with you and record what you eat as you are eating or immediately after.
- Be very detailed when recording combination food items such as sandwiches or hamburgers (include condiments)
- Be sure to include the cooking method used and what is used during cooking such as fats, oils, or salt
- Remember to include specific details about food items and brand names (i.e. Perdue's boneless skinless chicken breast)
- When recording, please refer to the "Documentation Checklist" to make sure you include all the necessary information!

Questions?

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Thank You!

- Please do not hesitate to contact us if you have any questions or concerns!
- Diabetesinstitute@ohio.edu

Dietary Analysis

The purpose of a 3-day food record is to better understand your dietary intake. We are interesting in your usual eating habits, so please do not change your diet.

This packet includes a personal information page and blank forms for a 3-day food record. The personal information will be used to better analyze your food record. Please complete this record according to the instructions that have been provided to you.

REMEMBER TO:

- ✓ Record everything you eat or drink (including water)
- ✓ Include portion sizes
- ✓ Describe how the food was prepared (baked, fried, grilled, etc.)
- ✓ List specific brand names of food/beverages when appropriate (i.e. Barilla whole grain spaghetti, Sargento string cheese)
- ✓ Include any vitamins, minerals, and/or supplements taken

If you have any questions regarding the 3-day food record, please contact Alexa Farrar at af152109@ohio.edu.

Personal Information

Age _____

Sex _____

Are you pregnant? (Circle one)

Yes No

Are you currently breastfeeding? (Circle one)

Yes No

Day 1

Time	Food	Description	Amount	Unit
7:30am	*Orange juice*	*Tropicana- Fortified w/ Vitamin D & calcium*	*6*	*ounces*
1:00pm	*Vitamin C supplement*	*NatureMade, 500 mg*	*1*	*tablet*
*Examples				

Day 1

Time	Food	Description	Amount	Unit

Day 1

Time	Food	Description	Amount	Unit

Day 2

Time	Food	Description	Amount	Unit

Day 2

Time	Food	Description	Amount	Unit

Day 2

Time	Food	Description	Amount	Unit

Day 3

Time	Food	Description	Amount	Unit

Day 3

Time	Food	Description	Amount	Unit

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