

RELATIONSHIPS AMONG DIET QUALITY, BMI AND COOKING SKILLS IN A GROUP
OF COLLEGE STUDENTS

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ABSTRACT

Students at a Midwest university (n=968) completed a survey regarding perceived confidence in cooking skills, food preparation frequencies, and average daily consumption of fruits, vegetables, whole grains, and low-fat dairy. A higher skills score was moderately correlated to higher vegetable intake ($r=0.29$, $p<0.001$). A higher cooking score was also associated with meeting the recommendations for vegetables ($p<0.001$), but was not associated with meeting recommendations for fruits ($p=0.22$), whole grains ($p=0.062$), or low-fat dairy ($p=0.24$). More confidence in skills score was correlated with a higher BMI ($r=0.12$, $p=0.001$), though correlation was low. Cooking skills score was also positively associated with food preparation frequency score ($p<0.001$). Although higher skills score was not strongly associated with fruit, whole grains, and low-fat dairy intake, students who have higher cooking skills may be more likely to prepare more vegetables. Encouraging cooking classes for college students may aid in meeting dietary recommendations.

Keywords: deskilling, diet quality, BMI, cooking skills, college students, food preparation frequency, self-efficacy

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TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF DEFINITIONS	x
CHAPTER 1. INTRODUCTION	1
Statement of the Problem.....	4
Purpose of the Study	4
CHAPTER 2. LITERATURE REVIEW.....	5
Factors in Food Choice	7
Factors that Influence Cooking.....	9
Availability and Use of Convenience Foods	9
Cost	11
Time Barriers	12
Sex.....	14
Family Meals and Household Shift.....	15
Barriers to Learning Cooking Skills	16
Lack of Home Economics/ Family Consumer Science Education	17
Lack of Cooking Skills in the Home.....	18
Involvement in Food Preparation.....	19
Diet Quality and Food Preparation	19
Demographics and Food Preparation.....	21

Body Mass Index and Food Preparation	22
Cooking Intervention Studies	23
Evaluation of Cooking Interventions	25
Gaps in the Literature.....	26
Summary	26
Research Questions	27
CHAPTER 3. METHODS	28
Experimental Design.....	28
Recruitment.....	28
Sampling Procedure	28
Cooking Knowledge and Skills Survey	29
Statistical Analysis.....	30
CHAPTER 4. RELATIONSHIPS AMONG DIET QUALITY, BMI AND COOKING SKILLS IN A GROUP OF COLLEGE STUDENTS. A JOURNAL ARTICLE SUBMITTED TO <i>THE JOURNAL OF NUTRITION EDUCATION AND BEHAVIOR</i>	31
Abstract	31
Introduction.....	31
Methods.....	35
Participants and Recruitment	35
Cooking Knowledge and Skills Survey	35
Measures	36
Degree of Self-efficacy in Cooking Skills	36
Frequency of Food Preparation.....	36
Demographics	37

Weight Status	37
Statistical Analysis.....	38
Results.....	38
Characteristics of Participants.....	38
Cooking Skills Self-efficacy	40
Cooking Attitudes	42
Food Preparation and Purchasing Behaviors	43
Food Preparation Frequency Scores (FPFS).....	44
Fast Food Intake.....	46
Associations with Diet Quality	47
Associations with BMI	49
Discussion.....	50
Implications for Research and Practice.....	55
Acknowledgements.....	56
CHAPTER 5. CONCLUSIONS	57
REFERENCES	59
APPENDIX A. IRB APPROVAL	66
APPENDIX B. COOKING SKILLS AND DIET QUALITY SURVEY.....	67
APPENDIX C. STUDY INFORMED CONSENT	74
APPENDIX D. EMAIL INVITATION	77

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Sex, age, class, ethnicity, BMI, and living situation in cooking skills questionnaire.....	39
2. Cooking self-efficacy of four main skills among a sample of college students (n=968)....	41
3. Perceived cooking skills score (PCSS) of participants by sex, grade, & BMI group (n=968)	41
4. Attitudes toward cooking among a sample of 968 college students.....	43
5. Reported frequency of cooking habits (%) in a group of 968 college students.....	44
6. Food preparation frequency score (PFPS) compared to sex, class, & BMI group among 968 college students.....	45
7. Food preparation and purchasing behaviors of 968 college students	46
8. Fast food intake by sex, class, & BMI group in a group of 968 college students	47
9. Male, female, and overall participants that met recommendations for vegetables, fruits, whole grains, and low-fat dairy among a sample of 968 college students	48
10. Relationships between BMI, cooking skills score, and food preparation frequency score among 968 college students.....	49
11. Relationships between BMI, cooking skills score, and food preparation frequency score among college students without a meal plan (n=639)	50

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. Social Ecological Model	8

LIST OF DEFINITIONS

- Body Mass indexa ratio of weight in kilograms divided by height in meters squared. Individuals with a BMI of < 18.5 are categorized as underweight, individuals with a BMI of 18.5 to 24.9 are categorized as normal weight, individuals with a BMI of 25.0 to 29.9 are categorized as overweight, individuals with a BMI of 30.0 to 39.9 are categorized as obese, and those with a 40.0 or higher BMI are considered morbidly obese (Centers for Disease Control and Prevention [CDC], 2010).
- Cooking Skills..... set of mechanical or physical skills used in meal preparation.
- Cooking from Scratch..... the art of cooking using non-processed ingredients and whole foods.
- Commercially Processed Foods..... fully or partially prepared foods in which a significant amount of preparation time, culinary skills, or energy inputs have been transferred from the home kitchen to the food processor and distributor.
- Deskilling..... the process in which individuals perform only a certain task or portion of a task and become divorced from the complete process (Braverman, 1972).
- Energy Imbalance..... more calories consumed through eating and drinking compared to calories burned through physical activity.

Family and Consumer Sciences (FCS) Family and Consumer Sciences is the comprehensive body of skills, research, and knowledge that helps people make informed decisions about their well-being, relationships, and resources to achieve optimal quality of life. The field represents many areas, including human development, personal and family finance, housing and interior design, food science, nutrition, and wellness, textiles and apparel, and consumer issues (formerly known as Home Economics).

Food Preparation..... preparing foodstuffs for eating, which generally requires the selection, measurement and combining of ingredients in an ordered procedure to achieve a desired result. It includes but is not limited to cooking.

FPFS..... acronym for Food Preparation Frequency Score.

Gatekeeper..... primary decision maker for the family.

Healthy Diet or Diet Quality..... meets recommendations for vegetables, fruits, low-fat dairy foods, and whole grains as well as not exceeding total fat, saturated fat and trans fat recommendations set by the United States Department of Agriculture (USDA), Dietary Guidelines for Americans (USDA, 2010).

Nutrient Poor, Calorie-dense Foods..... foods that are high in calories and fat or added sugars, but provide little other nutritional value such as vitamins, fiber, minerals, and protein.

PCSS..... acronym for Perceived Cooking Skills Score.

Self-efficacy.....the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations (Bandura, 1986)

CHAPTER 1. INTRODUCTION

With high obesity rates at the forefront of health problems today, many health experts are looking for answers and solutions to obesity worldwide. The transition from cooking from scratch to use of convenience foods in the past few decades has had a major impact on the weight status and overall health quality of adults and children internationally (Health Canada, 2011). The advancement of technology for food storage, preparation, and processing has resulted in a change in the knowledge and skills required to cook. Increased availability and variety of processed foods, time barriers, budgetary constraints, and the shifting of family priorities have also played a role in this regression of cooking (Health Canada, 2011, Lyon et. al, 2011). In addition, the opportunity for acquiring cooking skills and knowledge has been decreased in both the home and public education (Health Canada, 2011).

The fast-paced lifestyle common in society today can lead to higher consumption of convenience foods and less cooking in the home. The increased consumption of high calorie, nutrient-poor convenience foods is one of the many factors contributing to poor health and increasing obesity rates in the United States in both adults and children (Centers for Disease Control and Prevention [CDC], 2010). In the United States, increased consumption of convenience foods may also be a contributing factor to an individual's failure to meet the recommendations for nutrient-rich foods such as whole grains, low-fat dairy, fruits, and vegetables. Though many individuals are aware of the importance of a healthy diet, they still fail to meet the Dietary Guidelines for Americans recommendations, especially fruit and vegetable intake (Healthy People 2020, 2014). Indeed, only one in three individuals in the United States reports eating fruits or vegetables more than twice a day (Freeland-Graves & Nitzke, 2013).

One factor known to impact the food choices individuals make is where meals are consumed. Some have hypothesized that foods eaten outside of the home tend to be less

nutritious than food consumed at home (Reicks, Trofholz, Stang, & Laska, 2014). There has been a dramatic decrease in the percentage of meals consumed at home in the last few decades. In 1978, 78% of meals were eaten at home compared to 56% in 2000 (Levy & Auld, 2004). Not only does the increased presence of processed and convenience foods threaten the use of cooking skills, but the changing demographics of North American households make it less likely for children to learn cooking skills at home due to more parents working outside the home (Levy & Auld, 2004). Therefore as children grow into young adulthood, they may lack basic cooking skills (Lyon et al, 2011).

Many young adults, especially college-aged (18 to 24 years), may resort to fast or convenience foods for a large component of the diet (Levy & Auld, 2004). This is usually one of the first times young adults have to shop and prepare meals for themselves, as most no longer are living with parents or primary caregivers (Levy & Auld, 2004). National data suggests that this age group (ages 18 to 24 years) consumes diets that are high in overall fat intake and inadequate in key food groups for health such as low-fat dairy, whole grains, fruits and deep yellow and green vegetables (Healthy People 2020, 2014).

Some researchers view the change in cooking and food preparation as a negative influence of the food deskilling process (Jaffe & Gertler, 2006). The term deskilling comes from Braverman's theory of work industry where workers perform only a certain task or portion of a task and become divorced from the complete process, and therefore become deskilled (Short, 2003; Braverman, 1972). The same concept of deskilling can be applied to consumers (Kornelson, 2009). Jaffe and Gertler (2006) best described the idea of deskilled consumers as those who do not have and are systematically deprived of the information, knowledge, and analytical frameworks needed to make informed decisions that reflect their own 'fully costed'

interests. Without deliberate steps to counter this process, consumers become progressively less ‘skilled’ in absolute and relative terms, as they become increasingly distanced (in time, space and experience) from the sites and processes of production” (Jaffe & Gertler, 2006, p. 143).

This disconnect between consumers knowledge of cooking has contributed to the decline of learned cooking skills. Many consumers now do not have the skill or knowledge to perform food preparation, make traditional dishes from simple ingredients, or cook a meal from scratch (Kornelsen, 2009; Short, 2007). The loss of cooking skills continues consumers’ dependence on convenience foods or eating meals outside of the home. Young adults and college students may be extremely susceptible to the food deskilling process.

Fewer home cooked meals and more convenience foods have been associated with a low quality diet. According to National Health and Nutrition Examination Survey (NHANES III) results indicate that each meal purchased away from home provides about 130 calories more per day compared to food prepared at home (Reicks, et al., 2014). Home cooked meals also generally provide fewer calories and less total fat, saturated fat, and sodium than meals purchased away from home (Reicks et. al, 2014).

One of the challenges in a study of cooking skills among young adults is defining what the term “cooking” really is. Search engines such as EBSCO, Science Direct, PubMed, and Google Scholar were used to search for scholarly articles regarding cooking skills, cooking deskilling, food preparation skills, cooking skills and diet, diet quality and college students, food preparation and diet quality, cooking and BMI. Short (2003) tried to best define the concept of cooking skills in his study of domestic cooking. Cooking can often mean different things to different people on different occasions. The term “cooking skills” is generally defined as a set of mechanical or physical skills used in meal preparation, but according to Short (2003), the term

“cooking skills” seems to expand beyond these mechanical skills to encompass much more than the ability to perform cooking techniques.

Statement of the Problem

The deskilling of cooking skills among adults may be a contributing factor to overweight and obesity. There is evidence that involvement in food preparation and possessing cooking skills may help incorporate more healthful food choices such as fruits, vegetables, whole grains, and low-fat dairy for overall improved diet quality. Assessment of the level of skill may be difficult due to a dearth of scholarly articles that measure cooking skills.

Purpose of the Study

The purpose of this study is to understand the relationship between cooking skills of college students and the quality of their diet and weight status. A second purpose is to explore and further define the term cooking skills, in order that cooking skills levels among college students may be assessed.

CHAPTER 2. LITERATURE REVIEW

Energy imbalance has been identified as a cause of overweight and obesity among children and adults in the United States. Energy imbalance, defined as more calories taken in than calories expended, is the essential cause of undesirable weight gain (United States Department of Agriculture [USDA, 2010]. Other factors that may contribute to added weight include increased fast food and snack food consumption, increased sedentary activity time, and decreased occurrence of family meals (Jabs & Devine, 2006). Individuals in the United States are consuming more calories today compared to 40 years ago, with an increase of 31% more calories each day (Campaign Against Obesity, 2014). There are nearly 60 chronic diseases related to obesity; therefore, prevalence of chronic diseases such as diabetes and cancer has increased with increased obesity rates (Campaign Against Obesity, 2014). This is a grave concern since the individuals who are overweight and obese comprise a majority among all individuals in the United States causing increased health-related problems costing over 147 billion dollars in health care expenses each year (Centers for Disease Control and Prevention [CDC, 2014]).

Childhood obesity has nearly tripled and adult obesity has doubled since 1970. In the United States, nearly two thirds of adults are overweight or obese and one third of children and adolescents are obese (Flegal, Carroll, Ogden, & Curtin, 2010). Obesity rates have jumped to 25% in 32 states in the United States (CDC, 2010). This is in stark contrast to the rates in 1990, in which no state had obesity rates over 20% (Flegal et al., 2010). In order to maintain a healthy weight and control daily calories, the Dietary Guidelines for Americans include recommendations for an increased intake in nutrient-rich foods such as fruits, vegetables, and whole grains and a decrease in calorically-dense foods high in solid fats, sodium, and added sugars including sugar-sweetened beverages (USDA, 2010). Recommendations for saturated fats

include less than 10% of daily calories and trans fats as little as possible. Unfortunately, in the United States, the average individual dietary intake exceeds this recommendation for saturated fats and trans fat (National Cancer Institute, 2010). In 2010, solid fat (saturated fat) comprised an average of 19% of calories in the average American diet, 97% more than recommended (National Cancer Institute, 2010) The Dietary Guidelines for Americans also include recommendations for limiting refined grains to less than 3 ounces per day and adding whole grain products. In 2010, the average American consumed 6.3 ounces refined grains per day (USDA, 2010).

Unfortunately most adults consume too much processed foods and not enough nutrient-dense foods (USDA, 2010). National data suggests that college-aged adults consume diets that are high in fat and inadequate in recommended food groups such as low-fat dairy, whole grains, fruits, and deep yellow and green vegetables (U.S. Department of Health and Human Services [HHS], 2010). In the United States and Canada, inadequate diets start at a young age. For example, Chu, Storey, & Veugelers (2013) reported that 70% of child participants did not meet the recommendation for fruit and vegetable intake (median of vegetable and fruit intake was 4.2 servings) and 81% did not meet the recommendations for whole grains in their study of 3,398 fifth grade students in Alberta, Canada.

Energy imbalance and decreased ability to meet dietary recommendations may be related to where meals are consumed. Meals purchased outside the home comprised 42.0% of the food budget for the average person in the United States (Todd, Mancino, & Lin, 2010). According to data from the National Health and Nutrition Examination Survey (NHANES) and Continuing Food Survey on Intakes of Individuals (CFSII) of adults older than 20 years of age (n=13,429) from the time periods of 1994-1996 to 2003-2004, food prepared away from home lowers diet

quality (Todd et al., 2010). Foods prepared away from home contributes to the failure to meet recommended amounts of fruits, vegetables, and whole grains and leads to higher consumption of saturated fat and calories, contributing to obesity and energy imbalance. Foods consumed away from home provides an average of 130 to 134 additional calories per day compared to home-prepared meals. This would contribute to an estimated annual two pound weight gain for the average individual eating one meal away from home per week (Todd et al., 2010). Per 1,000 calories, food prepared away from home reduces fruit intake by 22.3%, dark green and orange vegetable intake by 31.0% and whole grain intake by 26.4% (Todd et al., 2010).

Factors in Food Choice

Whether preparing meals at home or choosing a meal at a restaurant, many factors contribute to the food choices individuals make. Koszewski, Yokum, Jones, & Boeckner (2007) found that the biggest influencing factors for food choices in a group of 115 Division 1 college athletes included convenience, taste, health, weight control, cost, and how food would affect performance. The Social Ecological Model (see Figure 1) illustrates possible factors that contribute to the food choices made by individuals each day including categories of individual factors, environmental settings, sectors of influence, and social and cultural norms, and values (Freeland-Graves & Nitzke, 2013).

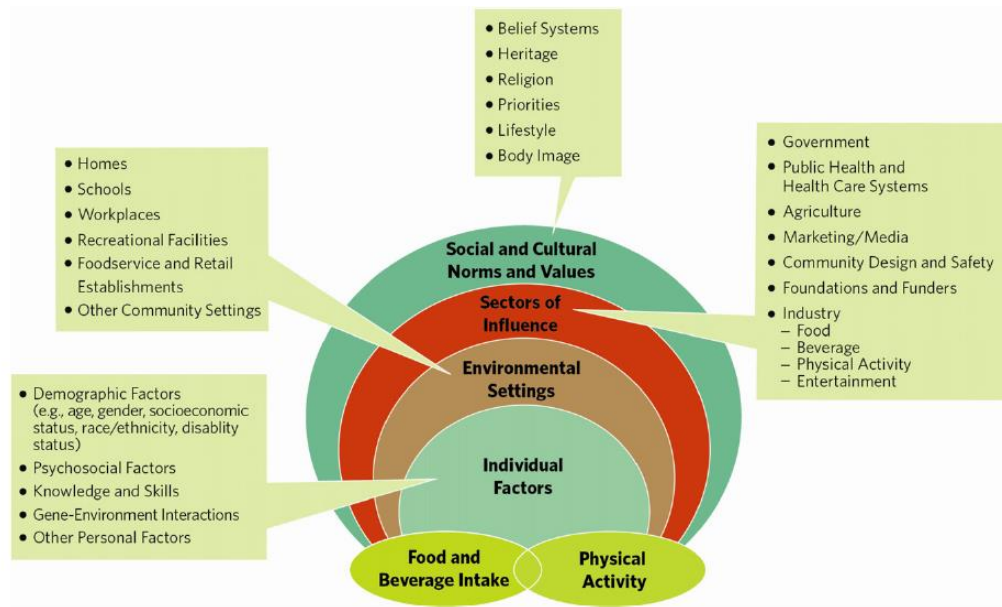


Figure 1. Social Ecological Model. Reprinted from the Dietary Guidelines for Americans (USDA, 2010)

Some of these factors in each tier of the Social Ecological Model for food choice can also be related to frequency of home food preparation. Having adequate nutrition knowledge and cooking skills, time, and convenience are individual factors that can contribute to frequency of home meal preparation. Access (or lack of access) to a home kitchen or other home food preparation facilities, the increased availability, and ease to access of convenience foods would be categorized as environmental determinants that contribute to food choice and frequency of food preparation. Economic concerns and the perceived increased cost involved for healthy eating can be identified as sectors of influence for both food choices and food preparation frequency. Media is an evident influence on the food choices that individuals make and can affect our use of convenience and fast food use, therefore also affecting home food preparation (Freeland-Graves & Nitzke, 2013).

Factors that Influence Cooking

The increased availability of convenience foods, perceived cost of preparing healthy foods compared to convenience foods, time barriers, and change in household dynamics are all identified factors that impact home food preparation. There is also a notable decrease in opportunities for adolescents to acquire food skills both at home and in the public education sector, creating a lack of food preparation skills that may also contribute to decrease of cooking among college students (Borr et al., 2012).

Availability and Use of Convenience Foods

A shift in food production in the twentieth century has caused an increase in the availability and amount of convenience foods that are mass produced. The deskilling of labor division has forced many tasks out of the home and into the hands of corporate capitals and food production companies (Jaffe & Gertler, 2006). This era began with production of some of the first convenience foods such as canned soups and breakfast cereals, and continued on to items such as pancake, cake, and stovetop casserole mixes; popular ready-to-eat cookies, crackers, and other snack items; refrigerated ready-to bake cookie dough and other mixes; and frozen ready-to-microwave entrees, vegetables and other items (Jaffe & Gertler, 2006).

This increase of variety of mass-produced convenience foods may be a contributing factor to rising obesity rates (Harris & Shiptsova, 2007). Not only is there an increase in the quantity and variety of convenience foods produced, but there is also an increase in the availability to purchase convenience foods outside of the home (Harris & Shiptsova, 2007). The National Restaurant Association (NRA) predicts 709 billion dollars in food service sales for 2015 from nearly one million U.S. restaurants (NRA, 2015). Strong evidence that shows that

those who eat out more than twice per week have greater risk for obesity (Stewart, Blisard, & Jolliffe, 2006).

According to a report from the National Health Interview Surveys (NHIS) for 1987 and 1992 and NHANES for years 1999-2000, commercially processed meals, purchased and eaten outside the home, increased by 11% between 1987 and 2000. Comparing 1987 and 1992, data suggests that the frequency of meals eaten outside of the home has significantly increased since 1987. In 1997, 47% of all food expenditures occurred from meals purchased outside of the home compared to 10% in 1960 (Jabs & Devine, 2006). In 2010, there was a slight decrease in food expenditure outside the home to 42%, but this percentage still remains high (Todd et al., 2010).

Larson, Neumark-Sztainer, Story, Wall, Harnack, and Eisenberg (2008) studied factors correlated with fast food intake in early adulthood (n= 1,686). They found that in five years (1999-2004), the proportion of males who reported frequent fast food intake rose from 23.6% to 33.0%. There was a 2.3% increase in fast food intake among females, from 20.5% at baseline to 22.8% at follow up during this same time. Comparatively, a study by Hetzler and Bruce (2002) revealed that half of college students reported eating out most weeks whereas 24% to 27% of total college students surveyed indicated eating out at least once per month (n=292). In a more recent study of fast food intake in college students, Stockton and Baker (2013) found that 68% of college students (n=543) reported eating fast food at least once per week.

Frequent fast food intake was more commonly reported by individuals of low to middle socioeconomic status in Larson and colleagues (2008) study of longitudinal changes in fast food intake from adolescence to young adulthood. In their study, fast food intake was also reported more often among individuals in mixed race categories. Fast food intake in females was found to be related to living situation, postsecondary student status, and weekly employment. Higher

intake was correlated with those who worked over 40 hours per week. Increases in fast food intake in females were also associated with higher reported perceived taste barriers to healthy eating, lunch frequency, snack frequency, time spent watching television, and availability of unhealthy foods at home. In males, peer support or having friends that care about healthy eating at baseline was associated with 14% lowered fast food intake at follow up (Larson et al., 2008).

The use of quick and convenience foods is often associated with the idea of saving time, but many other influences can contribute to the increased use of fast food products. Brunner, Van der Horst, and Seigris (2010) identified possible drivers for convenience food use. This research team hypothesized that increased cooking skills and nutrition knowledge inversely correlates with consumption of convenience foods. They found that older adults (no age category given) tended to use fewer convenience food products. Women also reported that they consumed fewer convenience products than men. For all ages of women, working full time and having children was related to less convenience food consumption (Brunner et al, 2010). Knowledge of nutrition, having cooking skills, “cherishing naturalness”, seeing cooking as a woman’s task, and thinking convenience items are expensive were all constructs negatively related to convenience food intake (Brunner et al., 2010). A similar theme was found in a study of athletes where female athletes were also found less likely to consume fast food than male athletes (Koszewski et al., 2007). Across all age groups, women may still cook more resulting in less reliance on fast food purchased outside of the home.

Cost

Many may believe that it is less expensive to eat fast food than to cook, but a USDA report showed that by volume, most fruits and vegetables were less expensive than foods higher in fat, saturated fat, and sodium such as convenience and fast foods (Freedman-Graves & Nitzke,

2013). Many young adults may believe they do not have the finances to cook, as shopping and food preparation is perceived to be more expensive than use of convenience foods (Lawe, 2013). In a study by Larson, Perry, Story and Neumark-Sztainer (2006) of 1,710 young adults aged 18 to 24, 25% of participants also reported cost as a barrier to cooking. Cost and economics largely impact food choices as financial issues have been identified as a reason for not meeting recommended dietary guidelines (Larson, Perry, et al., 2006).

Time Barriers

Time scarcity as defined by Jabs and Devine (2006) as “an individual’s perception or feelings of not having enough time to get everything done in one day” (p. 196). Food preparation is one task that is often perceived as a time consuming activity (Freeland-Graves & Nitzke, 2013). Time and convenience have been identified as influential on food choices since many people have the desire to limit time spent on food preparation.

Factors that deter individuals from cooking include availability and desire for convenience foods. Because perceived time scarcity has also been identified as one the factors that deter individuals from cooking, convenience foods may be both a cause and a result of decreased cooking in the average home in the United States. Many individuals want the convenience of food ready-to-eat without having to plan, prepare, and serve a meal, due to the perceived lack of time for that activity existing in society today. The food industry has responded to consumers’ desire to spend less time cooking with increased availability and choices of convenience foods (Jabs & Devine, 2006). There are endless choices of convenience foods made available to the consumer, but their appetite for new additions add supply to their demand. The number of quick, novel convenience products produced each year increased from 49 in 1987 to 419 in 2002, a 755% increase (Harris & Shiptsova, 2007). Since 1980, the sales of convenience and take-out meals

have drastically increased in restaurants and grocery stores. The TV dinner and invention of gadgets such as the microwave, rice cookers, bread machines, and numerous other small appliances have further met the desire for quick and effortless home food preparation (Jabs & Devine, 2006). Some of the most recent innovations include but are not limited to edible packaging, retort pouches of tuna fish, microwave ready meals with separate sauce pouches, and boxed macaroni and cheese with pre-hydrated cheese. Grocery retailers have ever-growing take-home entrees ready-to-eat in their “deli” and other profitable departments (Mintel, 2014). These convenience items can be high in calories, fat, and sodium, per portion.

With the increased use of convenience foods, less time is being spent preparing and consuming family meals in the home in the United States, United Kingdom, France and Belgium (Davis, 1995; Fischler, 2011, Fruh, Fulkerson, Mulekar, Kendrick, & Clanton, 2011; Mestag 2005). The typical person over the age of 18 spends an average of 33 minutes on food preparation each day (USDA, 2010). College students spend considerably less time, only 15 minutes on the average day, on food preparation according to the Economic Food Report (USDA, 2010). In their study of 1,687 young adults, Larson, Nelson, and Neumark-Sztainer (2009) found that 35% of male and 42% of female participants reported time constraints as an obstacle to preparing meals. Fifty percent of males and fifty-nine percent of females reported that they somewhat or strongly agree that they tend to “eat on the run.” Obese young adults reported social eating less often than normal weight and overweight participants. Obese individuals also had a slightly higher percentage of “eating on the run.” Incidentally, non-students were less likely to “eat on the run” (Larson et al.,2009). Time constraints were also a barrier reported by 33% of participants (n=1,710) in a similar study of young adults ages 18 to 23 (Larson, Perry, et al., 2006).

Among 3,254 adults over the age of 18 years of age, perceived lack of time can also affect the attitudes and motivations towards cooking according to a study by Daniels, Glorieux, Minnen, and Pieter van Tienoven (2012). For adults who were “time pressured” cooking was identified as an obligation or chore. Those not time pressured considered cooking more fun and enjoyable. Unemployment had no significant impact on motivation for cooking (Daniels et al., 2012).

Sex

Sex has been shown to be a major influence on whether individuals choose to cook as well as on food choices. Women continue to be the forerunners in home food preparation, but male meal preparation is on the rise (Daniels et al., 2012). In a study by Smith, Ng, and Popkin (2013) of trends of home food preparation from 1966 to 2008 (n=55,424) in 19 to 60 year old individuals, men’s involvement in cooking increased from 29.0% during 1965–1966 to 42.0% during 2007-2008 ($p \leq 0.001$) while women’s involvement decreased from 92.0% during 1965–1966 to 68.0% in 2007–2008 ($p \leq 0.001$). However, according to the national data of the American Time Use Survey (ATUS) conducted by the Labor Statistics (n=35,000), women both employed and unemployed continue to spend more time than men on grocery shopping, meal preparation, and clean-up (Hamrick & Shelly, 2003). About 18.0% of all women in the United States spend an average of 45.0 minutes grocery shopping on a given week compared to 39.0 minutes in 11.0% of men. Women spend an average of 47.4 minutes on food preparation and clean-up compared to an average of 15.0 minutes for men. In the United States, an average of 65.0 minutes was spent on eating activities on a given day; 39.0 minutes at home vs. 13.0 minutes at restaurants (Hamrick & Shelly, 2003). In one study, among college students, females were twice as likely to be involved in food preparation and those living in an apartment or house

were more likely to be involved in food preparation, than those living on campus (Larson, Perry et al., 2006).

Family Meals and Household Shift

As time spent working outside the home increases, projected that time spent on food preparation decreases (Reicks, et al., 2014). Finding from one study revealed that nearly 60% of women juggle family and work responsibilities and would prefer meal preparation to be less than 15 minutes; therefore, may turn to convenience foods (Freedman-Graves & Nitzke, 2013). The frequency of family meals has also decreased as a result of the shift in household dynamics. Working parents feel time constraints prevent them from getting their children involved with meal preparation so may rely on convenience foods (Woodruff & Kirby, 2013).

Woodruff and Kirby (2013) studied the association between family meal frequency and food preparation frequency, and self-efficacy for cooking and food preparation techniques among a sample of children and adolescents (n=145) ages 9 to 14 in Ontario, Canada. Self-efficacy is defined as “one’s perception of confidence in being able to perform a task or behavior” (Bandura, 1986). Researchers found that food preparation frequency was positively associated with self-efficacy for cooking among children and adolescents ($p<0.001$) (Woodruff & Kirby, 2013). Self-efficacy for cooking was also positively associated with food preparation techniques ($p<0.001$) and family meal frequency ($p=0.007$). Higher family meal frequency was also associated with greater self-efficacy for cooking in children ($p=0.01$) and higher positive family meal attitudes and behaviors ($p<0.001$) (Woodruff & Kirby, 2013).

With women’s presence in the workforce more prominent, there has been a change in the “gatekeeper” role from the 1940’s, when women were primarily responsible for meal preparation and food purchasing for the home. A “gatekeeper” is the primary decision maker for family food

choices (Hertzler & Bruce, 2002). The change in traditional gatekeeper patterns in food purchasing and preparation may be due to the increased meals away from home (Lewin, 1943; Hertzler & Bruce, 2002). A study by Hertzler and Bruce (2002) indicates a possible shift in gatekeeper roles in college students as more men are starting to take on the role. Daniels et al. (2012) reported that adults over the age of 24 (n=2,178) cooking remains more of a female role, and that more men are starting to do more shopping and food preparation in the home.

Barriers to Learning Cooking Skills

Family has been shown to be a major influence on the level of cooking skills among young adults. Backer (2013) reported that the mothers' home cooking during childhood had a significant effect ($p < 0.05$) on students cooking for self at present, but no effect from fathers' home cooking ($p = 0.39$). No positive effect of grandmothers' cooking was made on the general sample, but the male subsample (living independently) was affected by fathers' childhood cooking ($p = 0.39$). Mothers' recipes outscore ($p < 0.001$) other family recipes in terms of use, followed by maternal grandmothers' recipes ($p < 0.05$). Both mothers' and maternal grandmothers' recipes are owned ($p < 0.001$) and used ($p < 0.05$) significantly more than paternal grandmothers' recipes. Concurrently, female students were over five times more likely to own and use recipes from their mothers, and five times more likely to own and three times more likely to use recipes from grandmothers than male students (Baker, 2013). In a study by Hertzler & Bruce (2002), women reported cookbooks and magazines as recipe sources more often than men. Other studies report that, in general, college students most frequently use their family as their recipe sources over package labels (Hertzler & Fray, 1992, Hertzler & Fray, 1995). Previous findings are consistent with Hertzler's study where family was found to serve as a mentor and the primary recipe source (Hertzler & Fray, 1992).

Evidence shows that the family is often a primary source for recipes, but unfortunately cooking skills are not always being taught at home (Short, 2003; Slater, 2013). Children may learn some of these skills from other sources such as home economic courses in schools, but unfortunately courses such as Family Consumer Science or Home Economics are being discontinued (Slater, 2013).

Lack of Home Economics/Family Consumer Science Education

There is concern that food and nutrition knowledge and cooking skills are not being learned at home, therefore placing dependence on home economic classes in primary and secondary schools for food preparation knowledge. Unfortunately, home economics food and nutrition education often may be undervalued by school administration. The number and duration of these classes decreased since 1980 due to change in focus in education (Slater, 2013; Borr et al., 2012). Courses in home economics are decreasing with 28% fewer credit hours in 1998 compared to 1982 in the public education system including primary and secondary schools (Levy & Auld, 2004). Home economics or family and consumer sciences courses are an essential resource for developing important life skills that include meal planning; food preparation and food safety or sanitation; following recipe directions; financial management; team work; nutrition science; and the awareness of more complex food systems issues (Fordyce-Voorham, 2011, Slater, 2013). It is more important than ever to prepare adolescents to effectively navigate the complex foodscape in a healthy manner including food preparation skills they may not have learned (Fordyce-Voorham, 2011).

Family and consumer science (FCS) teachers report a noticeable reduction in food and nutrition knowledge in students over the past few decades (Krieger, 2014). Students may come to class with little prior knowledge regarding reading recipes, knife skills, or how to operate the

range due to decreased food preparation exposure at home (Slater, 2013). Students with solid basic skills such as knife skills, measuring techniques, and use of appliances, stand out. Many teachers see the need of starting FCS education earlier and making it mandatory in primary and secondary schools since students are no longer learning these skills at home (Slater, 2013).

Though no evidence has been found to support a relationship between lack of cooking skills and overweight and obesity, there is growing evidence that lack of or limited school and home based food and nutrition education is detrimental to health and as such, rejuvenating FCS education would be beneficial (Slater, 2013).

Lack of Cooking Skills in the Home

Young adults who have not acquired cooking skills at home or as a part of primary and secondary education may lack cooking skills necessary to do any cooking on their own (Lyon et al, 2011). Lack of cooking skills was identified as a potential barrier for cooking in young adults and college students in a British study. Twenty-nine percent of participants reported their lack of cooking skills as a barrier to cooking meals (Lawe, 2013). Similarly, in a study of young adults ages 18-23 (n=1710) by Larson, Perry et al. (2006), 76.8% males and 81.7% females, reported that they viewed their skills as adequate, while 23.0% of male and 18% of females reported lack of cooking skills as a barrier.

According to a study by Beck (2007) of 64 home cooked meals by 32 families on two separate nights of the week, many home cooked meals contain processed foods in at least moderate amounts, possibly due to limited cooking skills. Interestingly, in a study by Van der Horst and Siegrist (2010), amount of convenience food used was not affected by time spent cooking which shows that it is likely that most individuals use some convenience products in their daily life regardless of the need to save time. According to Short (2003), use of

commercially processed foods may not necessarily be due to lack of knowledge, but due to convenience or other factors. Based on the literature, there is no evidence that the word “cook” refers to only the use of fresh and raw foods (Short, 2003). As Short (2003) concludes, cooking with raw, fresh, and already prepared foods requires and utilizes cooking skills. In a study by Backer (2013), the definition of “home cooked meals” was defined as “a meal where at least one or more fresh ingredients were processed into cooked food.”

Involvement in Food Preparation

Diet Quality and Food Preparation

Current research has shown the benefits of having food preparation knowledge for achieving a healthier diet. Several studies have shown that increased involvement in food preparation is associated with improved diet quality in both children and young adults (Reicks et al., 2014). Helping with meal preparation was associated with higher fruit and vegetable intake and higher self-efficacy ($p < 0.001$) for selecting food (Woodruff & Kirby, 2013). Young adults, ages 18 to 23, were more likely to meet dietary recommendations for fat ($p < 0.001$) fruits ($p < 0.001$) vegetables ($p < 0.001$), whole grains ($p < 0.003$), and calcium ($p < 0.001$) with more frequent home meal preparation and less fast food consumption (Larson, Perry, et al., 2006).

Positive results were found in a study done by Chu, Storey, and Veugelers (2013) who examined the association between frequency of home food preparation involvement and quality of dietary intake ($p = 0.001$) in fifth grade student participants. In this study of 3,398 children ages 10 to 11 years old recruited in Ontario, Canada, 63% of the children reported helping with meal preparation at least one time weekly, while 13% did not help at all with home meal preparation. Children involved in food preparation at least one time per day reported eating significantly more vegetables and fruits than their peers. Moreover, they consumed an average of

one more full serving of vegetables and fruits than those children who reported never helping with meal preparation ($p < 0.001$). Not only was fruit and vegetable intake higher, but children who helped with meal preparation had higher intakes of whole grains and low-fat milk, as well as meat ($p = 0.04$).

Larson, Story, Eisenberg and Neumark-Sztainer (2006) reported the relationship between involvement in preparing and shopping for food and the dietary quality of middle and high school students. Nearly half (49.8%) of the 261 participants reported helping shop for groceries, and 68.6% helped with meal preparation at least one time per week. Most reported helping with meal preparation less than three times per week with only 29% helping more than three times per week. Food preparation and food shopping were found to be moderately and significantly correlated ($r = 0.31$, $p < 0.001$). In this study, Asian Americans had the greatest involvement in preparation and shopping as well as adolescents of low socioeconomic status ($p < 0.001$). Middle schoolers were more likely to help with food preparation compared to high school students. In general, preparing food was related to more healthful food choices, as preparing food was positively associated with fruit consumption in male adolescents and fruit and vegetable consumption in female adolescents. Adolescents that helped with food preparation seven days a week ate one half more serving of fruit and one half serving more of vegetables than those with less involvement. Helping with food preparation was also inversely associated with soft drink consumption and positively correlated with lower intake of fat and higher intake of key nutrients such as folate, fiber, and vitamin A in females. On the contrary, involvement in shopping resulted in a slightly positive association ($p < 0.10$) with less healthful food choices such as fried foods in female adolescents (Larson et al., 2006).

A similar study by Larson, Perry, Story, and Neumark-Sztainer (2009) of 1,710 young adults (ages 18 to 24) examined the involvement in the preparing and purchasing of food in relation to fast food use and overall “dietary quality.” Diet quality was defined by the Healthy People 2010 objectives which targeted intake of fat, calcium-rich foods, fruits, vegetables, and whole grains (Larson, Perry et al., 2009). These researchers found that those who reported using food preparation skills more frequently consumed less fast food and were more likely to meet the Healthy People 2010 objectives. Of those that reported high food preparation skills, 31% were consuming five servings of fruits and vegetables and 18% met the guideline for deep yellow vegetables (at least one serving of the recommended three or more servings of vegetables per day) compared to 2% with reported low involvement. On the contrary, only 23% of females and 13% of males wrote a grocery list weekly and 33% and 21% bought vegetables weekly, both behaviors associated with a healthy diet (Larson, Perry et al., 2009).

Not all studies point to an association between home meal preparation and healthier eating. In a study of Australian young adults ages 26 to 36 (n=2,814), higher involvement in meal preparation was not consistently associated with better diet quality. Women who shared the cooking with another person had slightly higher intake of low-fat dairy products, soy products, and vegetable intake ($p=0.011$). The amount of high fat meats did not differ between the groups of men, though those who did have sole responsibility for food preparation had higher intake of lean meats. There was no association between level of involvement and consumption of take-out type foods (e.g. fast food) for both sexes (Smith, et al., 2010).

Demographics and Food Preparation

Family or individual income may or may not influence whether or not individuals are more likely to prepare meals at home. Higher socioeconomic status and those who were married

often shared responsibility for meal preparation in a study by Smith et al. (2010). However, previous studies showed lower socioeconomic status individuals had higher involvement in meals (Harnack, Story, Martinson, Neumark-Sztainer, & Stang, 1998) and no associations at all between socioeconomic status and meal involvement (Larson, Story, et al., 2006). In a study by Larson, Story, et al. (2006), Adolescents of low socioeconomic status and Asian Americans had the greatest involvement in preparation and shopping (Larson, Story et al., 2006).

Body Mass Index and Food Preparation

Body mass index (BMI) is one indicator of body fatness and can be a marker for weight status. Individuals with a BMI of < 18.5 are categorized as underweight, individuals with a BMI of 18.5 to 24.9 are categorized as normal weight, individuals with a BMI of 25.0 to 29.9 are categorized as overweight, individuals with a BMI of 30.0 to 39.9 are categorized as obese, and those with a BMI of 40.0 or greater are considered morbidly obese (CDC, 2010).

Kant and Graubard (2004) used data from NHIS of 1987 and NHANES of 1999-2000 to examine trends in frequency of consuming commercially prepared meals and eating out with BMI and nutrient intake in 5,330 individuals over 18 years of age. No relationship between BMI and weekly frequency of consuming commercially processed meals was found in the years of 1987 and 1992. In 1999-2000, no association was found between higher BMI and eating out in males. A modest positive association of weekly commercially processed meals and higher BMI in females was found (Kant & Graubard, 2004). French, Harnack, and Jeffrey (2000) also found a positive association between consumption of commercially processed meals and BMI in women, but not in men.

No studies were found that showed a positive relationship between a healthy BMI and food preparation skills. In one study, on average, underweight and normal-weight participants

reported lower food preparation activities than participants who were overweight or obese (Larson, Story, et al., 2006). Those who were involved in meal preparation at least once weekly consumed an average of 245 kcal more per day than those never involved in food preparation (Chu, Storey, & Veugelers, 2014).

Cooking Intervention Studies

Not only are financial constraint, time, gender responsibilities, household shifts, and the level of cooking skills factors in whether or not individuals actively participate in food preparation, but lack of confidence in cooking skills may also act as a barrier to preparing food in the home. According to Condrasky, Williams, Cantalano, and Griffin (2011), self-efficacy in food preparation as well as interest in cooking, healthful eating knowledge, and increased fruit and vegetable consumption can be accomplished with a gain or improvement in perceived cooking skills. In this case self-efficacy of cooking refers to the ability and confidence to perform a variety of food preparation methods.

Studies show that hands-on interventions are beneficial for improving self-efficacy and food preparation knowledge. In study by Levy and Auld (2004), a group of college students (n=33) who were involved in a hands-on cooking class and participated in supermarket tour showed a positive shift in self-efficacy after trying different cooking techniques. A positive shift in cooking knowledge was found in this group of students as well as those involved in a food demonstration. Both of these significant shifts are consistent with previous studies.

Existing curricula such as “Cooking with Kids” positively influenced fruit and vegetable preference in 961 students involved in the “Cooking with Kids” programs that involved both a cooking and tasting portion for 4th graders. Vegetable intake improvement was found to be greater in males ($p=0.03$). All students in these programs showed an increase in self-efficacy for

food preparation ($p=0.01$ and $p=0.08$). No differences in fruit preferences were noted, thus change in vegetable preference most likely drove the scores (Cunningham-Sabo & Lohse, 2014).

A pilot study at a university in the United Kingdom involved the implementation of a series of cooking classes for college students as a part of a cooking club taught by trained fellow college students. The classes focused on beginners skills with a focus on teaching students how to use fresh foods to prepare dishes and reasonably priced meals that they would normally buy already made. Before the class, 76% of participants stated they knew they should be eating five servings of fruits and vegetables daily. Only 25% of male and 50% of female first-year students stated that they viewed their diet as healthy. Twenty-eight percent reported spending 30 minutes or more preparing meals, where as 41% were spending 15 to 30 minutes preparing meals. After completion of the course, 84% of participants thought they had improved their cooking skills and 75% felt more confident in their cooking abilities (Lawe, 2013). With improved skills and increased confidence, students may now have the desire to use these skills more often.

Another way to improve cooking skills in college students as suggested by Brown and Richards (2010) is to integrate a cooking assignment into a nutrition course. The “Cook an Entrée” assignment included preparing an entrée with at least three ingredients. Students learned that barriers such as limited time and lack of ability could be overcome and some recognized the social benefits of preparing a meal for others (Brown & Richards, 2010). This type of assignment can help students realize that increasing their cooking skills can be a practical and valuable tool for daily living.

Kubota and Freedman (2009) created a hands-on basic cooking skills development program for college students ($n=20$). Students showed an increased self-efficacy of cooking and food preparation skills after completion of the course ($p < 0.05$); however, students did not show

an increase in targeted food group intake with this increase in cooking confidence. This demonstrates that despite increased self-efficacy, other environmental factors such as finances, taste preference, or grocery access may hinder improved eating habits among college students (Kubota & Freedman, 2009).

Evaluation of Cooking Interventions

Some existing interventions for increasing cooking skills have been reported with documented success such as the “Cooking with a Chef program”. This program is a hands-on class for school cooks and parents that teaches skills to enhance skills for menu planning, food purchasing, food preparation, and food consumption behaviors with the help of professional chefs. The main objectives of the program were to increase confidence in cooking, as well as increase consumption of fruits and vegetables, and increase use of herbs (Condrasky et. al, 2011).

Reicks, Trofholz, Stang, and Laska (2014) reviewed current research on cooking programs and food preparation interventions in relation to health outcomes in adults to evaluate the overall impact of these programs. After review and validation, 28 studies were selected, but all varied in the type of group, intervention and design style, type of assessment and program length. Food frequency questionnaires, 24 hour recalls, and eating habit surveys were used as well as qualitative interviews to assess consumption patterns of the different population groups. The impact of cooking intervention on dietary intake was evaluated in 19 of the 28 studies with 16 having a positive impact. Of the 16 studies that showed a change in intake of targeted food groups, only 12 had control groups. Of the 12 that had control groups, 5 studies showed that intervention participants had greater improvement in their diet than the control groups. A few studies showed increased cooking confidence, two showed increase in cooking activity, and two

cooking class interventions showed a positive relationship between cooking attitude and enjoyment (Reicks, et al., 2014). The review did indicate that home preparation and cooking programs result in favorable changes in dietary intake as most of the studies produced positive effects with their intervention (Reicks et. al, 2014).

Gaps in the Literature

As mentioned earlier, “cooking skills” is not a universal term and therefore difficult to define. Cooking may refer to the mere preparation of food, the application of heat or the use of cooking with the use of fresh, raw foods.

Short (2003) found that the definition of cooking skills is much more complex than practical and mechanical abilities. Cooking may go beyond the ability to perform food techniques such as preparing vegetables, microwaving, cooking rice, grilling, stir-frying, poaching, basic knife skills, and making a white sauce. Cooking skills also involve conceptual and perceptual skills and knowledge which may include the understanding of how taste, color, and texture of foods react when combined, heated or chilled (Short, 2003). When evaluating cooking skills, an evaluation tool should involve conceptual, perceptual, planning and fundamental skills of food nutrition, food sanitation, chemistry as well as organizational skills (Ternier, 2010; Short 2003). Organizational skills may include the ability to menu plan, purchase food, the ability to cook under pressure, and the ability to make sure meal components are ready to eat at the same time (Short, 2003).

Summary

As outlined in Levy and Auld (2004), learning to cook empowers people to prepare healthful meals, provides a strong sense of personal achievement, involves all five senses, and provides the knowledge that allows people to determine more healthful alternatives when eating

away from home. Improving cooking skills may lead to better food choices such as more whole grains, low-fat dairy, fruits, and vegetable intake. Having self-efficacy in cooking skills may also have the ability to increase cooking frequency and an individual's interest in cooking (Levy & Auld, 2004).

In young adults and children, meal involvement has been shown to improve the consumption of recommended intake of fruits, vegetables, and whole grains especially evident in increasing fruit and vegetable intake. Few studies show a relationship between BMI and cooking, but one study revealed that overweight and obese individuals are more likely to be involved in cooking than normal weight individuals (Larson, Story et. al, 2006). Many tested cooking programs have shown improvement in cooking confidence and self-efficacy in preparing foods which in turn can increase the likelihood and motivation to cook.

Research Questions

This study is structured to help answer the following research questions: Is adequate food preparation knowledge and having cooking skills related to recommended intake of fruits, vegetables, low-fat dairy, and whole grains? Is there a relationship among perceived adequate cooking skills and diet quality? Is there a relationship between having cooking skills and BMI? I hypothesize that college students with perceived adequate cooking skills will have better diet quality and will more likely meet the Healthy People 2010 dietary recommendations for low-fat dairy, whole grains, fruits, and vegetables. I hypothesize that a healthy BMI and cooking skills are positively associated among college students.

CHAPTER 3. METHODS

Experimental design

This study was approved by the North Dakota State University Institutional Review Board (IRB) (Appendix A). This study used a cross-sectional research design that includes the examination of the relationship between perceived cooking skills and diet quality compared to BMI in college students.

Recruitment

College students enrolled in a university general education wellness class at a Midwest university were recruited to participate in the survey. The survey was made available online to this group of students via blackboard. The survey was an online Qualtrics survey with no time limit, but took approximately 10 minutes to complete. Additionally, the survey was distributed via email on the campus listserv to recruit additional college student participants.

Sampling Procedure

In November 2014, the assistant researcher presented an overview and explanation of the survey to the two sections of the wellness class. An extra credit opportunity was offered for compensation for participation in the survey. The Qualtrics online survey was then sent out to the class via email describing the study and providing the survey link. If they chose to participate, students clicked on the Qualtrics survey link which would first bring them to the informed consent. If the participant agreed to consent for the survey, the link proceeded to the actual online survey (Appendix B). The survey results were anonymous, however, the assistant researcher was able to identify students who completed the survey via a student list generated by Qualtrics in the mail history, for compensation purposes. The names were not linked to the

survey itself, but this information was used to inform the instructor which students earned extra credit points.

Additionally, students who were recruited from the campus listserv had access to the survey via an email invitation (appendix D) for two weeks. Students who chose to participate could click on the Qualtrics survey link in the email which led them to the informed consent. If the participant agreed to consent for the survey (Appendix C), the link proceeded onto the actual online survey (Appendix B).

Cooking Knowledge and Skills Survey

Participants completed the 38-item survey (Appendix B) to receive compensation for participation in the survey. The survey addressed current cooking habits, food purchasing and meal habits, dietary intake questions, and perceived ability to perform food preparation tasks. For example, participants ranked their confidence or ability to “make a salad” or “steam vegetables” from very confident to not at all confident.

The survey was composed of questions from validated surveys from Woodruff and Kirby’s (2013) study of self-efficacy of cooking and cooking technique in children ages 9 to 14. Meal preparation self-efficacy questions came from Condrasky and colleagues’ (2011) validated survey for young adults and from Larson, Perry, et al. (2006). Questions regarding attitudes towards cooking came from Levy and Auld’s (2004) questionnaire for their study on cooking demonstrations in sophomore-college student participants. Food frequency questions, food preparation frequency, and purchasing behaviors were taken from the project EAT (Eating Among Teens) I and II surveys used for data collection in the Todd, Mancino, and Lin (2010) study as well as for Larson, Perry et al. (2006) study of young adults. Permissions for use were

listed on the various surveys and the project EAT website:

http://www.sph.umn.edu/pdf/research/epi/eat/EAT-III_Survey.pdf.

The survey was piloted with a paper version among a group of dietetic, hospitality, and family and consumer science education college students (n=42) for further validation and readability before final survey launch. The survey took between 5 to 15 minutes for students to complete. Students were able to give feedback to the researcher. Student feedback was taken into account to modify final survey prior to entry into online Qualtrics form.

Statistical Analysis

The collected data were analyzed using SAS (version 9.3; SAS Institute Inc., Cary, NC, 2011). Pearson correlation analyses were performed to determine the correlation of the independent variables (vegetable intake, fruit intake, whole grain intake, low-fat dairy intake, fast food intake, BMI) on the dependent variables, perceived cooking skills score (PCSS) and food preparation frequency score (FPFS). Chi-squares were also used to determine frequencies and differences in responses per variable. Descriptive statistics and percentages were calculated to examine frequencies of food preparation and purchasing habits. The significance level was set at $p < 0.05$ for each statistical analysis. Not all participants answered all the survey questions resulting in varying number of responses for each question and a variation in sample sizes.

**CHAPTER 4. RELATIONSHIPS AMONG DIET QUALITY, BMI AND COOKING
SKILLS IN A GROUP OF COLLEGE STUDENTS.**

**A JOURNAL ARTICLE SUBMITTED TO *THE JOURNAL OF NUTRITION
EDUCATION AND BEHAVIOR***

Abstract

College students at a Midwest university (n=968) completed a survey regarding their perceived confidence in cooking techniques, food preparation frequencies, and their average daily consumption of fruits, vegetables, whole grains, and low-fat dairy to measure diet quality. A higher cooking skills score was moderately correlated to higher vegetable intake ($r=0.29$, $p<0.001$). A higher cooking score was also associated with meeting the recommendations for vegetables ($p<0.001$), but was not associated with meeting recommendations for fruits ($p=0.22$), whole grains ($p=0.062$), or low-fat dairy ($p=0.24$). More confidence in cooking skills score was correlated with a generally higher BMI ($r=0.12$, $p=0.001$), though the correlation was low. Cooking skills score was also positively associated with food preparation frequency score ($p<0.001$). Although higher cooking skills score was not strongly associated with fruit, whole grains, and low-fat dairy intake, students who have higher cooking skills may be more likely to prepare and consume more vegetables. Encouraging cooking classes for college students may aid in meeting dietary recommendations for college students.

Keywords: BMI, college students, cooking skills, deskillling, diet quality, meal preparation, self-efficacy

Introduction

With high obesity rates at the forefront of health problems today, many health experts are looking for answers and solutions to obesity worldwide. The transition from cooking from

scratch to use of convenience foods in the past few decades has impacted weight status and overall health quality of adults and children internationally (Health Canada, 2011). In the United States, increased consumption of convenience foods may also be a contributing factor to an individual's failure to meet the recommendations for nutrient-rich foods such as whole grains, low-fat dairy, fruits, and vegetables. Only one in three individuals in the United States reports eating fruits or vegetables more than twice a day (Freeland-Graves & Nitzke, 2013). National data suggests that college-aged adults consume diets that are high in fat and inadequate in recommended food groups such as low-fat dairy, whole grains, fruits, and deep yellow and green vegetables (U.S. Department of Health and Human Services [HHS], 2010).

Fewer home cooked meals and more convenience foods have been associated with a low quality diet. According to National Health and Nutrition Examination Survey (NHANES III) each meal purchased away from home provides about 130 calories more per day compared to food prepared at home (Reicks, et al., 2014). Home cooked meals also generally provide fewer calories and less total fat, saturated fat, and sodium than meals purchased away from home (Reicks et. al, 2014). The advancement of technology for food storage, preparation, and processing has also resulted in a change in the knowledge and skills required to cook. Increased availability and variety of processed foods, lack of finances, time, sex, and the shifting of family priorities have also played a role in this regression of cooking (Health Canada, 2011, Lyon et. al, 2011).

Some researchers view the change in cooking and food preparation as a negative influence of the food deskilling process (Jaffe & Gertler, 2006). The term deskilling comes from Braverman's theory of work industry where workers perform only a certain task or portion of a task and become divorced from the complete process, and therefore become deskilled (Short,

2003; Braverman, 1972). This disconnect between consumers' lack of knowledge of cooking has contributed to the decline of the utilization of cooking skills. Many consumers now do not have the skill or knowledge to perform food preparation, make traditional dishes from simple ingredients, or cook a meal from scratch (Kornelsen, 2009; Short, 2007). The loss of cooking skills continues consumers' dependence on convenience foods or eating meals outside of the home. Young adults and college students may be extremely susceptible to the food deskilling process.

A few studies have shown positive benefits of having food preparation knowledge for achieving a healthier diet. For example, increased involvement in food preparation was found to be associated with improved diet quality in both children and young adults (Reicks et. al, 2014). Young adults, ages 18 to 23, were more likely to meet dietary recommendations for fat ($p<0.001$) fruits ($p<0.001$) vegetables ($p<0.001$), whole grains ($p<0.003$), and calcium ($p<0.001$) with more frequent home meal preparation and less fast food consumption (Larson, Perry, et al. 2006). Fifth grade children involved in food preparation at least one time per day reported eating significantly more vegetables and fruits ($p=0.001$) than their peers (Chu, Storey, &Veugelers, 2013). Moreover, they consumed an average of one more full serving of vegetables and fruits than those children who reported never helping with meal preparation ($p<0.001$) (Chu et al., 2013). Not only was fruit and vegetable intake higher, but children who helped with meal preparation had higher intakes of whole grains and low-fat milk, as well as meat ($p=0.04$) (Chu et al., 2013). Larson, Story, Eisenberg and Neumark-Sztainer (2006) found that in general, preparing food was related to more healthful food choices, as preparing food was positively associated with fruit consumption in male adolescents and fruit and vegetable consumption in females. Adolescents who helped with food preparation seven days a week ate one half more serving of fruit and one

half serving more of vegetables than those with less involvement. Helping with food preparation was also inversely associated with soft drink consumption and positively correlated with lower intake of fat and higher intake of key nutrients such as folate, fiber, and vitamin A in females. (Larson et al., 2006). Finally, in a study involving 1,710 young adults (ages 18 to 24), those who reported using food preparation skills more frequently consumed less fast food and were more likely to meet the Healthy People 2010 objectives (Larson, Perry et al., 2009). Further, of those that reported high food preparation skills, 31% were consuming five servings of fruits and vegetables (Larson, Perry et al., 2009).

Having cooking skills may not be the only factor that is important; self-efficacy in these cooking skills may impact how often individuals cook. Self-efficacy is defined as “one’s perception of confidence in being able to perform a task or behavior” (Bandura, 1986). According to Condrasky, Williams, Cantalano, and Griffin (2011), self-efficacy in food preparation as well as interest in cooking, healthful eating knowledge, and increased fruit and vegetable consumption can be accomplished with a gain or improvement in perceived cooking skills. Helping with meal preparation was associated with higher fruit and vegetable intake and higher self-efficacy ($p < 0.001$) for selecting food in children from age 9 to 14 (Woodruff & Kirby, 2013). Few studies have studied the relationship between BMI and cooking, but one study did reveal that overweight and obese individuals are more likely to be involved in cooking than normal weight individuals (Larson, Story et. al, 2006).

There is evidence that involvement in food preparation and possessing cooking skills may help incorporate more healthful food choices such as fruits, vegetables, whole grains and low-fat dairy for overall improved diet quality. Therefore, the purpose of this study is to understand the

relationship between perceived cooking skills and reported food preparation frequency among college students with diet quality and BMI.

Methods

Participants and Recruitment

Data was collected through an online questionnaire which was distributed via campus wide email for any college student enrolled at one Midwest university. All students were invited to participate. If students chose to participate, students clicked on the Qualtrics survey link which led them to the informed consent form. Continuing on to the questionnaire indicated consent.

Cooking Knowledge and Skills Survey

The 38-item questionnaire was composed of questions from validated surveys from Woodruff and Kirby's (2013) study of self-efficacy of cooking in children ages 9 to 14. Meal preparation self-efficacy questions were modeled from Condrasky and colleagues' (2011) validated survey for young adults and from Larson, Perry, et al. (2006) study of diet quality of young adults. Dietary intake questions, food preparation frequency, and purchasing behaviors were modeled from the project EAT (Eating Among Teens) I and II surveys used for data collection in the Todd, Mancino, and Lin (2010) study as well as for Larson, Perry, et al., (2006) study of young adults.

The final questionnaire addressed current cooking habits, food purchasing and meal habits, dietary-intake questions, and perceived ability to perform food preparation tasks. For example, participants ranked their confidence or ability to "make a salad" or "steam vegetables" on a four-point scale from not confident at all to very confident. Students were also asked questions on frequency of food preparation tasks such as making a dinner with both a protein and

a vegetable with responses such as daily, four to six times per week, two to four times per week, weekly, two to three times per month, monthly or never.

Measures

Degree of Self-efficacy in Cooking Skills

Measures of perceived confidence in performing certain cooking techniques or skills (i.e. using knife skills in the kitchen, preparing vegetables, and preparing lettuce) were modified from a survey by Condrasky (2011) from their study on evaluating culinary nutrition education programs. These questions were used to establish a Perceived Cooking Skills Score (PCSS) to possibly identify any deskilling of cooking techniques among the current study participants. Participants were asked to report their confidence in 19 different cooking techniques using a Likert scale (1=not confident, 2=somewhat confident, 3=confident, 4=very confident). These categories were summed into either not confident, confident, or very confident to describe the students' perceived confidence or self-efficacy in abilities to perform these techniques. This score was used as a summary of confidence in cooking skills referred to as the PCSS to examine association among BMI, class, and sex. When the scores from the 19 items were summed, scores could have a possible range from 19 to 76. These scores were placed into three categories. A PCSS from 19 to 38 were considered to be "not confident", scores from 39 to 59 were considered to be "confident" and 60 to 76 were considered to be "very confident".

Frequency of Food Preparation

Participants were asked food preparation questions such as how often they performed certain food preparation tasks in the last year in order to assess a Food Preparation Frequency Score (FPFS). Questions included how often students 1) purchased fresh vegetables, 2) prepared a green salad, 3) prepared a dinner with chicken, fish, or vegetables or 4) prepared an entire

dinner for two or more people. Possible responses were “never”, “one to five times per year”, “monthly”, “weekly”, or “daily”. These items were summed to form a FPFS that was used to examine associations among demographic groups. Frequencies of each behavior was given a numerical value of 1, 2, 3, 4, or 5 where 1 represented “never” and 5 represented “daily” food preparation. These numerical values were summed and summed scores could range from 5 to 20. Preparation scores ranging from 5 to 8 were considered low, 9 to 12 were considered moderate, and 13 to 20 were categorized as “high”. This type of scoring was modeled from scoring of a food preparation score in Larson and Perry’s, et al. (2006) study of diet quality in young adults.

Demographics

Demographics including sex, ethnicity, age, college class, college enrolled in, and living situation were all self-reported. Living situation questions included “where students live” (e.g. parents, roommates, alone, on-campus residence hall, on-campus apartment, off-campus apartment and off-campus house). Students who lived on-campus were also asked questions about purchased meal plans.

Weight Status

Height and weight were self-reported; height in feet and inches and usual weight was reported in pounds. These values were used to compute body mass index (BMI values) as kg/m^2 . BMIs were categorized into groups; <18.5 was categorized as underweight, 18.5-24.9 was categorized as normal weight, 25-29.9 was categorized as overweight, and BMI 30 and over was categorized as obese (Center of Disease Control and Prevention [CDC], 2010). BMI’s over 40, categorized as morbidly obese, also fell into the obese category.

Statistical Analysis

All analyses were conducted with SAS Institute Inc. 9.2, 2011 (Cary, NC). Pearson correlation analyses were performed to determine the correlation of the independent variables (i.e. vegetable intake, fruit intake, whole grain intake, low-fat dairy intake, fast food intake, and BMI) on the dependent variables, FPFS, and PCSS. Chi-squares were also used to determine frequencies and differences in responses per variable. Descriptive statistics and percentages were calculated to examine frequencies of food preparation and purchasing habits. The significance level was set at $p < 0.05$ for all estimates. Not all participants answered all the survey questions resulting in varying number of responses for each question and a variation in sample sizes.

Results

Characteristics of Participants

A total of 968 valid questionnaires were received comprising of 57.0% female (n=552) and 43.0% male (n=416) participants. There was a potential of 14,269 total students that could have participated in the questionnaire, with a response rate of 6.8%. The majority of the participants were white, making up 92.7% of the sample. As a whole, the university's student population is comprised of 80.5% white students. Of the 968, 59.0% (n=570) of the college students had a BMI in the normal range, 21.5 % (n=209) were classified as overweight, and 14.9% (n=144) were obese. There were also 4.6% (n=24) of students that were underweight.

Only 33.9% (n=329) reported having a meal contract on-campus, which primarily consisted of freshmen and sophomore students. The amount of reported meal plans trended down as grade and age increased. Of the sample, 37.8% (n=367) of the participants lived on-campus with 26.3% (n=255) in residence halls with "no kitchen" and 11.5% (n=112) living in on-campus

apartments. The remaining 62.3% (n=605) resided off-campus. Further demographic characteristic can be viewed in Table 1.

Table 1. Sex, age, class, ethnicity, BMI, and living situation in cooking skills questionnaire

	%	n
Sex (n=968)		
Male	43.2	416
Female	56.8	552
Age (n=966)		
18 years	15.3	148
19 years	20.0	193
20 years	15.4	149
21 years	12.5	121
22 years or older	36.8	355
Class (n=965)		
Freshmen	24.0	234
Sophomores	18.0	176
Juniors	16.8	164
Seniors	22.5	215
Graduate students	18.7	182
Ethnicity (n=968)		
White	92.7	898
Non-white	7.3	70
Body Mass Index (BMI) n=968		
Underweight (<18.5)	4.6	45
Normal weight (18.5-24.9)	59.0	571
Overweight (25-29.9)	21.5	208
Obese or morbidly obese (>=30)	14.9	144
Living Situation (n=972)		
On -Campus –residence hall (limited kitchen)	26.2	255
On -campus- apartment (full-kitchen)		
Off -campus- apartment	11.5	112
Off -campus-house	21.5	209
Other	39.1	380
	1.7	16
Living Status (n=972)		
Alone	11.8	115
With Parents	4.6	45
With Roommates/Others	83.6	812

Cooking Skills Self-efficacy

The majority of participants were confident or very confident in their cooking skills with only 5.0% (n=51) of the participants scoring in the “not confident” category (See Table 3). Most participants reported preparing meals for themselves at least two times per week (74.2%, n=718). Approximately 30.0% (n=294) of participants reported making meals for themselves daily. Those who prepared meals less frequently, four to six times per week, made up 17.3% (n=168). Those who reported preparing meals two to four times per week comprised 26.4% (n=256). Only 15.1% (n=146) reported that they prepared meals weekly.

The students were asked to rank their confidence in performing 19 different cooking techniques. The PCSS ranged from 22 to 76. The mean PCSS was 58, which falls in the “confident” category. Table 2 shows the breakdown of four main cooking techniques pertinent to the research questions. Most students felt confident in cleaning and cutting up fresh fruit, with 16.5% answering “not confident” or only “somewhat confident” in this skill. Using knife skills in the kitchen was a skill that most felt confident in with 18.3% answering “not confident” or “somewhat confident”. Nearly 16.0% were “somewhat confident” in cleaning and preparing a head of lettuce.

Table 2. Cooking self-efficacy of four main skills among a sample of college students (n=968)

Cooking Technique	Not Confident %	Somewhat confident %	Confident %	Very Confident %
Using knife skills in the kitchen (chopping, mincing etc).	3.5	14.8	35.4	46.4
Prepare fresh or frozen vegetables	3.0	13.5	34.6	48.9
Clean and cut up fresh fruit	1.2	8.4	34.6	55.8
Clean, cut, and prepare a head of lettuce	7.6	15.8	29.9	46.7

Table 3. Perceived cooking skills score (PCSS) of participants by sex, grade, & BMI group (n=968)

PCSS	No confidence (19-38) %	Confident (39-59) %	Very Confident (60-76) %	p-value
Sex				
Males	7.4	40.9	51.7	
Females	3.6	34.2	62.2	0.0010*
Class				
Freshmen	10.3	45.7	44.0	
Sophomores	5.1	43.8	51.1	
Juniors	3.7	36.0	60.3	
Seniors	2.8	35.9	61.3	
Graduate Students	3.3	22.0	74.7	<0.0001*
BMI Group				
Underweight (<18.5)	2.0	51	46.7	
Normal weight (18.5-24.9)	6.0	38	55.8	
Overweight (25-29.9)	5.7	36.8	57.5	
Obese (>30)	2.0	29.2	68.8	0.003*
Total (n)	5.2	37.1	57.7	

Chi Square analysis between variables sex, grade, and BMI Group.

*Indicates significance level of $p < 0.05$

Most of the participants (77.8%, n=757) reported taking some type of food preparation class such as home economics/family consumer sciences, basic foods, or another type of food lab in high school where basic food preparation technique curriculum is offered.

Cooking Attitudes

Most participants in the study agreed that “cooking helps me eat more healthfully”. Most also agreed or strongly agreed that “they like to cook”, with 80.0% reporting this attitude. Most students did agree that “cooking is time consuming” with nearly 80.0% of the college sample sharing this attitude. However, only 52.3% agreed or strongly agreed that “cooking takes too much time”. For the question “cooking takes too much time”, this group of college students split down the middle, indicating that for some, time could be a barrier to cooking. The attitude that “cooking is expensive” was also split between disagree and agree.

The PCSS revealed that nearly 95.0% of students had “confidence”, in other words, had perceived self-efficacy in cooking skills. However, nearly 25.0% disagreed that they “felt confident in my various cooking techniques” (Table 4).

Table 4. Attitudes toward cooking among a sample of 968 college students

Cooking Attitude	Strongly Disagree %	Disagree %	Agree %	Strongly Agree %
Cooking helps me eat more healthfully	0.1	5.5	46.6	47.8
Cooking is hard	23.2	54.6	19.2	3.0
Cooking takes too much time	7.9	39.8	41.1	11.2
I like to cook	1.9	11.9	45.2	41.0
I feel confident in my various cooking techniques	2.9	21.4	45.9	29.8
Cooking is expensive	9.9	42.2	38.1	9.8
Cooking is time consuming	1.9	16.7	63.0	18.4

Food Preparation and Purchasing Behaviors

Most participants, 67.56% (n=656), reported that they themselves cook most of the meals in their home. Only 4.0% (n=45) reported living with their parents, and 22.5% (n=219) reported that family cooked most of the meals. Females cooked more of their own meals with 71.0% (n=394) of females cooking for themselves while 62.5% (n=262) males reported that they cook most of their meals themselves. Eighty-three percent of the participants reported that they lived with others, but only 10.0% (n=96) reported that roommates or others “do most of the cooking”. The majority of participants (92.5%, n=896) reported purchasing their food from grocery stores with only 1.45% (n=14) purchasing most of their food from convenience stores.

Cooking from scratch without the use of convenience products was pretty evenly distributed as done “rarely”, “sometimes” or “often” (see Table 5). When asked how often participants make foods without the use of convenience foods, more than half answered “sometimes” (29.8%, n=289) or “often” (25.6%, n=248). Nearly 21% (n=198) answered “rarely” do they cook without the use convenience foods. Only 12.4% reported cooking without

convenience foods “all of the time” (Table 5). Thirty-seven percent (n=277) reported making foods with three plus ingredients “often” and 20.8% (n=202) report they make foods with more than three ingredients nearly “all of the time”. As student class increased, more students reported cooking with more than three ingredients. The use of convenience foods seemed to decrease as class increased, with more upper classmen making meals without convenience foods “often” or “all the time”.

Table 5. Reported frequency of cooking habits (%) in a group of 968 college students

Frequency	Cooking with three plus ingredients	Cooking from scratch without use of convenience foods
Never	2.6	11.9
Rarely	11.1	20.4
Sometimes	28.5	29.8
Often	37.0	25.6
All the time	20.8	12.3

Food Preparation Frequency Scores (FPFS)

The mean FPFS was 13.6 of a possible 20, showing fairly high food preparation frequency. Perceived cooking skills score (PCSS) was shown to be associated with FPFS (p<0.001). The two were found to be moderately positively correlated (r=-0.44, p<0.001) so as PCSS increased, FPFS also increased.

Chi square analysis revealed that FPFS was also associated with student class (p<0.001) and sex (p<0.001). FPFS scores increased as student class increased with 19.2% (n=45) of freshmen and 58.0% (n=107) of graduate students scoring highest. Females also had higher FPFS with 40.8% (n=225) of female participants scoring high and 24.3% (n= 101) of males scoring in the high category for FPFS (Table 6).

Table 6. Food preparation frequency score (FPFS) compared to sex, class, & BMI group among 968 college students

FPFS	Low ^a %	Moderate ^b %	High ^c %	p-value
Characteristic				
Sex				
Male	29.6	46.1	24.3	
Female	17.2	42.0	40.8	<0.0001*
Class				
Freshmen	35.5	45.3	19.2	
Sophomore	31.8	43.2	25.0	
Junior	20.1	48.2	31.7	
Senior	15.6	47.6	36.8	
Graduate	7.1	34.1	58.8	<0.0001*
BMI Group				
Underweight (<18.5)	26.7	44.4	28.9	
Normal (18.5-24.9)	22.9	43.4	33.7	
Overweight (25-29.9)	24.4	43.1	32.5	
Obese (30+)	16.8	46.6	36.8	0.67
Total (n)	33.7	22.5	43.8	

Numerical score of 5-8 for food preparation questions, b) numerical score of 9-12 for food preparation questions, c) Numerical score of 13-20 for food preparation questions.

Modeled from Larson, Perry (2006)

*Indicates significance of $p < 0.05$.

Nearly half of the surveyed students reported purchasing vegetables monthly (52.3%, $n=506$), while only 29.3% ($n=284$) reported purchasing vegetables weekly. Surprisingly, more students prepared a dinner with chicken, fish, and vegetable at least weekly (48.9%, $n=373$) or prepared a meal for 2 or more people (32.8%, $n=318$) at least weekly. See Table 7 for the analysis of the questions that comprised the food preparation frequency score.

Table 7. Food preparation and purchasing behaviors of 968 college students

Behavior Frequency	Never % (n)	1-5 times per year % (n)	Monthly % (n)	Weekly % (n)	Daily % (n)
Purchase fresh vegetables ^a	9.8	7.0	52.3	29.3	1.6
Prepare a green salad ^a	15.8	10.2	26.5	38.7	8.8
Prepared a dinner with chicken, fish, or vegetable ^a	3.6	2.9	16.3	48.9	28.3
Prepared an entire dinner with 2 or more people ^a	12.0	14.8	24.7	32.8	15.7

^aThe results of these questions were compiled to create the Food Preparation Frequency Score. Modeled from Larson, Perry et al. (2006)

Fast Food Intake

Most participants, 38.8% (n=377), reported eating fast food weekly and 42.2% (n=284) reported eating fast food monthly or less. About 16% (n=155) reported eating fast food two to four times per week. Male students reported higher frequencies of fast food intake than female students. Fast food intake among BMI groups was similar. Nearly 37% (n=209) of those in the normal weight BMI group consumed fast food weekly, 15.5% (n=89) consumed fast food two to four times per week. Forty-three percent (n=90) of those in the overweight category ate fast food weekly and in the same BMI category, 14.3% (n=30) consumed fast food two to four times per week. Around 48% (n=70) of those that were in the obese category ate fast food weekly and 22.2% (n=32) reported that they ate fast food two to four times per week (See Table 8).

PCSS had no significant association with fast food intake ($p=0.115$), so having adequate perceived cooking skills did not affect reported frequency of fast food intake.

Table 8. Fast food intake by sex, class, and BMI group in a group of 968 college students

Fast Food Intake	Monthly or less %	Weekly %	2-4 times per week %	5+ times per week %
Sex				
Male	35.2	39.5	21.0	4.3
Female	47.5	38.3	12.2	2.0
Class				
Freshmen	54.1	33.9	10.3	1.7
Sophomores	44.0	37.9	15.3	2.8
Juniors	37.8	43.3	14.6	4.3
Seniors	34.4	39.5	21.4	4.7
Graduate	38.5	41.2	18.7	1.6
BMI Group				
Underweight (<18.5)	69.0	17.7	8.9	4.4
Normal (18.5-24.9)	45.7	36.5	15.5	2.3
Overweight (25-29.9)	38.3	43.1	14.3	4.3
Obese (>=30)	25.7	48.6	22.2	3.5
Total (n)	42.2 (410)	38.8 (377)	16.0 (155)	3.0 (29)

Associations with Diet Quality

Only 23.0% (n=225) of participants reported that they met the recommended servings of vegetables. This was slightly higher in females than males: 21.6% (n=90) of males and 24.5% (n= 135) of females ($p<0.001$). Nearly 52% (n=493) of students met fruit recommendations of an average of at least two servings of fruit per day. Reported fruit intake did not differ by sex. Ability to meet the recommendations for fruit, however, did trend down as BMI category increased. Around 45% percent (n=433) of students reported consuming at least three sources of whole grains per day, with a higher percentage of males meeting recommendations, 48.5% (n=202) compared to 41.8% (n= 231) of females. For low-fat dairy intake, only 39.2% (n=380)

of all students met the recommendations, trending down as student class increased with 50.8% (n=119) of freshmen meeting recommendations compared to 23.0% (n=42) of graduate students. A higher proportion of males met recommendations for low-fat dairy (45.67%, n=190) than females (34.4%, n=190) as well (See Table 9).

Table 9. Male, female, and overall participants that met recommendations for vegetables, fruits, whole grains, and low-fat dairy among sample of 968 college students

Sex	Males		Females		Both Sexes	Between Sexes	Met Recommendations
	Met %	Did not meet %	Met %	Did not meet %	Total Met %	<i>p</i> -value	PCSS <i>p</i> -value
Vegetables	21.6	78.4	24.5	75.5	23.0	< 0.0001*	<0.0001*
3+							
Fruits	51.9	48.1	50.2	49.8	50.9	0.5915	0.222
2+ servings							
Whole grains	48.5	51.5	41.8	58.2	44.7	0.037*	0.062
3+ servings							
Low-fat	45.6	54.4	34.4	65.6	39.3	0.004*	0.248
3+ servings							

Chi Square Analysis of sex and PCSS compared to intake groups.

* Indicates significance set at $p < 0.05$.

A PCSS was moderately correlated with higher vegetable intake ($r=0.29$, $p<0.001$), but not necessarily with other food groups. The PCSS was correlated to fruit intake, but correlation was extremely low ($r=0.073$, $p=0.02$). Higher PCSS was associated with meeting the recommendations for vegetables ($p<0.001$), but not for fruits ($p=0.222$), whole grains ($p=0.062$) or low-fat dairy ($p=0.248$) compared to the guidelines of Healthy People 2010 (Healthy People, 2010) as illustrated in Table 9.

As shown in Table 10, the FPFS did not have a strong correlation with meeting the recommendations for whole grains ($r=-0.07$, $p=0.0389$) or low-fat dairy ($r=-0.02$, $p=0.377$). A

higher FPFS did show a moderate positive correlation to higher vegetable intake ($r=0.44$, $p<0.0001$) and a positive low correlation to higher fruit intake ($r=-0.19$, $p<0.0001$).

Associations with BMI

The PCSS was associated with BMI ($p=0.03$) as illustrated in Table 3. Those that had higher PCSS had higher BMIs, though the correlation was low ($r=0.12$, $p<0.001$). As BMI increased, percentages of students who scored “very confident” in reporting cooking skills also increased. Fifty-five percent ($n=318$) of “normal weight” students compared to 68.75% ($n=99$) of “obese” students scored “very confident” in their cooking skills, however there were over twice the amount of “normal weight” individuals compared to those in the “obese” category (Table 10).

The FPFS was not correlated ($r=0.058$ $p=0.07$) nor was it found to have any association ($p=0.32$) with BMI. Therefore, food preparation frequency did not have a relationship to a student’s BMI or weight status.

Table 10. Relationships between BMI, cooking skills score, and food preparation frequency score among 968 college students

	Perceived Cooking Skill Score (PCSS)	Food Preparation Frequency Score (FPFS)	BMI	Vegetables	Fruits	Whole Grains	Low-fat dairy
PCSS	1.000 --- 968	0.44891 <0.0001** 956	0.12676 <0.0001** 968	0.29135 <0.0001* 965	0.07397 0.0214* 967	0.06648 0.0389* 965	-0.2839 0.3776 968
FPFS	0.44867 <0.0001** 968	1.000 --- 968	0.05860 0.0713 948	0.44238 <0.0001** 965	0.18825 <0.0001** 967	0.03833 0.2343 965	-0.03039 0.3450 968
BMI	0.12676 <0.0001** 948	0.05860 0.0713 948	1.000 --- 948	-0.01533 0.6377 946	-0.09596 0.0031* 948	0.02355 0.4697 945	0.02653 0.4146 948

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

The same data was run with the exclusion of the 329 students that had meal plans to see if this made a difference in their PCSS (n=639). These results show that BMI is no longer correlated with PCSS ($r=0.126$, $p=0.08$). Fruit’s correlation to PCSS increased slightly and is now significant, but correlation is still low ($r=0.15$, $p<0.0001$). The FPFS and PCSS remain moderately correlated as well as FPFS and vegetable intake ($r=0.49$, $p<0.0001$) and FPFS and fruit intake ($r=0.27$, $p<0.0001$) (Table 11).

Table 11. Relationships between BMI, cooking skills score, and food preparation frequency score among college students without a meal plan (n=639)

	Perceived Cooking Skill Score (PCSS)	Food Preparation Frequency Score (FPFS)	BMI	Vegetables	Fruits	Whole Grains	Low-fat dairy
Perceived Cooking skill score	1.000 --- 639	0.44048 <0.0001** 639	0.13426 0.008 626	0.30315 0.0001** 638	0.14987 <0.0001** 638	0.03646 0.3579 638	-0.00993 0.8022 639
Food Preparation frequency Score	0.44048 <0.0001** 639	1.000 --- 968	0.06167 0.1232 626	0.48939 <0.0001** 638	0.27197 <0.0001** 638	0.01890 0.6337 638	0.01345 0.7343 639
BMI	0.13426 0.008 626	0.06167 0.1232 626	1.000 --- 626	0.00214 0.9574 625	-0.07328 0.0669 626	0.06746 0.0920 625	0.07936 0.0472* 626

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

Discussion

This study describes the self-efficacy in cooking skills and the level of involvement in food preparation and their associations with diet quality (meeting recommendations for fruits, vegetables, whole grains, and low-fat dairy) and BMI. With the possibility of deskilling of cooking in this population, the researchers wanted to estimate level of participant confidence in cooking skills to see if this affected dietary intake. Most participants scored “confident” or “very

confident” in self-efficacy of cooking skills; however, nearly 25.0% indicated that they disagreed that they were confident in their cooking skills. Most participants reported taking some sort of food preparation lab in high school, so lack of cooking skills may have not been as large of barrier as anticipated. Though this may indicate that they had adequate skills at one point, it may have been beneficial to ask the length of the classes or when the class was taken to get a better understanding of their skills level and possibility of becoming divorced from the process. This prior exposure to food preparation curriculum may decrease the possibility of deskilling from cooking. However, if students no longer utilize these skills, this phenomenon could still exist.

Although a majority of the participants reported feeling “confident” or “very confident” in their cooking skills, few actually met the recommendations for fruits, vegetables, whole grains, and low-fat dairy. Of all of the food groups, fruit was most likely to be met, but still was only met by 50% of the participants. Reporting higher self-efficacy in cooking skills did correlate with a higher intake of vegetables and the ability to meet the recommendations for vegetables.

Surprisingly, over half of the students reported cooking with more than three ingredients at least “often” and “almost always”. However, only 38% reported cooking a meal from scratch without the use of convenience ingredients at least “often” or “all of the time”, with only 12.4% reported doing this task “all of the time”. This may indicate that cooking may rely heavily on convenience foods for this population. Though most convenience foods do not require much more than heat and rehydration, many products still may require three ingredients or more (e.g. water, one other ingredient and some “bought” mix); thus, these foods would still be considered convenience products. This reliance on convenience foods could result in deskilling, divorcing students from the process of cooking from scratch.

In the current study, most participants reported fast food intake weekly or two to four times per week. However, fast food intake was not related to “confidence in cooking skills”. Food preparation involvement was also not found to be associated with fast food intake in a study of young adults in Australia (Smith et. al, 2010). Even though students were not eating out as often, most students reported preparing food with convenience foods compared to cooking meals that required more ingredients.

A higher FPFS was found to have a moderate positive correlation with vegetable intake and fruit intake, meaning the higher the FPFS, the higher the fruit and vegetable intake. This is consistent to a previous study by Larson, Perry et al. (2006) where more involvement in food preparation seemed to help participants meet the dietary objectives of Healthy People 2010. However, a study of Australian young adults did not show an association between meal involvement and better diet quality (Smith et al., 2010). FPFS and PCSS was also found to be positively correlated, consistent to the results of Woodruff and Kirby (2013) study, although cooking score and food frequency was measured differently.

Female students reported performing more food preparation tasks than males among the 968 participants that completed the survey. Females also reported higher food preparation frequencies than male students. This is consistent with Larson, Perry et al. (2006) and the general trend that women tend to take part in more food preparation than men. Female students did often perform food preparation tasks more such as meal planning, writing a grocery list, and cooking foods without convenience foods ingredients compared to their male counterparts. Males, however, were more likely to meet recommendations for whole grains and dairy compared to females. This may be due to the higher calorie needs of males compared to women. Class rank was also an important factor, as frequency of food preparation tasks increased as class increased.

Intake of food groups seemed unchanged between classes other than for low-fat dairy, where younger classmen had higher intakes than upperclassmen. The higher percentages in younger students meeting dairy recommendations is logical due to the fact that younger students were more likely to have meal plans that gave them easy access to milk.

As one of the few studies that examined whether cooking skills has an effect on BMI, this study suggests that there is an association between perceived cooking skills and a higher BMI. However, most students ranked their skills as at least adequate so it may not be the best overall indicator. FPFs, however, was not associated with a higher BMI, contrary to findings by Larson, Perry et al., (2006) in which underweight and normal-weight participants reported lower food preparation activities than participants who were overweight or obese. This indicates that cooking skills and food preparation frequency may not necessarily be a factor for weight status.

Attitudes about cooking also could have affected how often this group of students cooked. As the research outlined, time and finances could also act as barriers to food preparation. In this study, nearly 81.0% agreed that cooking was time consuming; however, only 52.0% agreed that “cooking took too much time”. Nearly half of the students also agreed that “cooking is expensive”. Interestingly, nearly 86.0% of students agree that they “liked to cook”. Other than these questions, the this study did not focus on time which may be a major barrier to food preparation frequency and eating more fruits, vegetables, whole grains, and low-fat dairy.

Strengths of this study were the large sample size. The questions utilized validated questions from the Youth and Adolescent Food Frequency Questionnaire and Project EAT III to analyze dietary intake. The current study not only examined cooking skills relationship with diet quality, but food preparation frequency as well.

Some limitations of the study include a sampled population that was not diverse, i.e. consisting of primarily white students. The study also was only conducted at one university, in the Midwest, and only at one point in time. Another limitation included the difficulty to define cooking and cooking skills in developing the survey instrument.

The food preparation questions used to score the food preparation score may have not been the best indicator of food preparation due to the nature of the questions. Questions regarding cooking skills and techniques are based on self-reported and self-perceived skill and not comparable to culinary skills (by definition). Though the questions asked about confidence in these skills, the questionnaire did not address how often participants utilized these skills. It may have been beneficial to ask both confidence and frequency of performing these skills. In addition, when asked about attitude toward cooking, nearly 25% of the students disagreed with the statement, “I have confidence in cooking techniques”, which was a much larger difference than what the cooking skills score revealed. Confidence in these skills were ranked on a four-point Likert scale; it may have been more revealing to rank each skill on a 10-point scale to better understand perceived self-efficacy in cooking skills.

Given that the past research on this topic has shown that those who had more involvement in food preparation were more likely to have better diet quality and given our somewhat supportive results regarding food frequency preparation and diet quality, further research is needed to improve the understanding of these relationships. However, the current study did show that confidence in cooking skills was related to meeting the recommendations for vegetables, but not necessarily other food groups. Few identified studies have examined cooking skills relationship with diet quality, but rather have studied food preparation involvement’s relationship with diet quality.

As in any self-reported survey, individual factors such as mood, time scarcity, and social desirability could have influenced how questions were answered, affecting the overall study results. This study asked for personal questions such as height and usual weight which may not have been reported accurately or truthfully.

Implications for Research and Practice

Many cooking interventions, such as attempts to increase knowledge and importance of cooking skills, already exist in hopes of improving diet quality of children, adolescents, and adults. Cooking interventions may be a way to increase intake of nutrient-dense food groups, especially vegetables, as outlined in this study.

The results of this study revealed high levels of perceived confidence or self-efficacy in performing cooking skills. More self-efficacy in perceived cooking skills was moderately correlated to higher food preparation frequency. This shows that cooking skills do have a relationship to frequency of food preparation. This may signify that the lack of cooking skills may not be the main problem, but rather the ability to put these skills into practice. As outlined in previous research, other factors such as the use of convenience foods, time scarcity, and finances can also contribute to lack of food preparation and failure to meet recommendations. Cooking interventions still would be beneficial for these types of students to continue using these skills in hopes to integrate them into their daily and lifelong food preparation routine.

Further research in regards to cooking skills and diet quality in a more diverse sample is warranted. Only a few studies have been done on this topic and revealed more associations with cooking skills confidence and meeting recommendations for not only vegetables, but fruit and whole grains as well.

Acknowledgements

I would like to thank Kayeromi Gomez for his statistical guidance and assistance for this research project.

CHAPTER 5. CONCLUSIONS

This study aimed to examine the relationships between perceived cooking skills in college students and their diet quality. An overall goal of the study was to examine whether BMI was related to perceived cooking skills of these college students. It has been found that food preparation may help with meeting recommended intake for food groups such as fruits, vegetables, whole grains, and low-fat dairy that comprise a healthy diet. Currently, many college students fail to meet these recommendations. This may be related to the increased use of convenience foods that are generally nutrient-poor, calorie-dense options. As established, there are many factors that could act as barriers or factors related to home food preparation from scratch including the increase in convenience foods, perceived time barriers, financial barriers, gender/sex differences, and lack of cooking skills. Now more than ever, there is a disconnect between cooking and the consumer due to the heavy reliance on processed foods causing a deskilling of cooking skills. This study focused on whether students perceive their cooking skills as adequate and how that relates to food preparation and meeting recommendations for food groups.

The hypothesis of the study was that students with adequate cooking skills would meet more of the recommendations for fruits, vegetables, whole grains, and low-fat dairy. The results of this study did not fully support our hypothesis. Many of the college students surveyed did not meet recommendations for any of the food groups, especially vegetables. The study did reveal that most students perceived their confidence in cooking skills as adequate or very adequate. However, higher confidence in cooking skills was only strongly associated with meeting the recommendations for vegetables.

Past research revealed that involvement in food preparation could aid in meeting the recommendations for fruits, vegetable, whole grains and low-fat dairy. FPFS associated with meeting these recommendations and was moderately positively associated with higher intake of fruits and vegetables, but not other food groups.

In this study, many students reported some food preparation at least weekly, if not two to four times per week. This may indicate that lack of cooking skills may not have been the major factor in inability to meet recommendations. FPFS was found to be positively correlated to cooking skills score, whereas a higher PCSS signified a higher FPFS. When it came to FPFS, upper classmen often performed more food preparation than lower classmen.

We also hypothesized that those with higher cooking skills would have a lower BMI. The results revealed that a higher cooking skills score was correlated to a higher BMI, though the correlation was low. Further research needs to be done regarding BMI and cooking skills to further understand this relationship.

Major limitations for the study include the lack of ethnic diversity in the sample with nearly 93% of the participants reported as white. The study also focused on the confidence of the ability to perform cooking skills and not necessarily how often they perform these tasks. This current study also did not address time barriers for food preparation. Other personal factors such as taste and preference could largely affect why these food group recommendations were not met.

Though in this group of college students higher cooking skills did not correlate to meeting most of the recommendations for a healthy diet, higher confidence in cooking skills was associated with higher intake of vegetables. The relationship between cooking skills, diet quality and BMI need to be further researched as only a few studies exist at this time.

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APPENDIX A. IRB APPROVAL



October 21, 2014

Dr. Sherri Stastny
Health, Nutrition & Exercise Sciences
EML 351

Re: IRB Certification of Exempt Human Subjects Research:
Protocol #HE15078 , "Relationships among diet quality, BMI, and Cooking Skills in a Group of College Students"

Co-investigator(s) and research team: Jenna Kourajian

Certification Date: 10/21/14 Expiration Date: 10/20/17
Study site(s): NDSU
Sponsor: n/a

The above referenced human subjects research project has been certified as exempt (category # 2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the revised protocol materials (received 10/20/14).

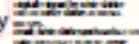
Please also note the following:

- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

Sincerely,

Kristy Shirley 

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult www.ndsu.edu/irb. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD

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Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

NDSU is an IGDA university

APPENDIX B. COOKING SKILLS AND DIET QUALITY SURVEY

(This survey was in “Qualtrics” form)

Gender/Sex

- a. Male
- b. Female
- c. Do not want to disclose

Race

- a. White/Caucasian
- b. African American
- c. Hispanic
- d. Asian
- e. American Indian
- f. Mixed
- g. Other

Age in years (those under 18 years of age are not eligible for this study):

- a. 18
- b. 19
- c. 20
- d. 21
- e. 22
- f. 23
- g. 24
- h. Over 24

Grade Level/Class

- a. Freshman
- b. Sophomore
- c. Junior
- d. Senior
- e. Graduate Student

What college are you enrolled in?

- College of Agriculture, Food Systems and Natural Resources
- College of Arts, Humanities and Social Sciences
- College of Business
- College of Engineering
- College of Human Development and Education
- College of Pharmacy, Nursing and Allied Sciences
- College of Science and Mathematics
- College of University Studies

○ Graduate School and Interdisciplinary Studies

Height:

Feet: _____

Inches: _____

Usual weight (in lbs.) _____

Section One

1. Did you take any of the following lab courses in high school or middle school? (select all that apply)
 - a. Basic cooking skills lab
 - b. Family consumer science lab
 - c. Other lab that involved food preparation
 - d. No lab class in high school or middle school involving food preparation

2. Where do you currently live?
 - a. On campus
 - i. Residence hall
 - ii. On campus apartment (LLC, Niskanen, Bison Court, etc)
 - b. Off campus
 - i. House
 - ii. Apartment
 - iii. Other

3. Do you currently live:
 - a. Alone
 - b. With parent(s)
 - c. With others (roommate(s), friend(s), family, significant other)

4. Are you currently participating in a meal plan on campus?
 - a. Yes
 - b. No

5. If yes, which meal plan do you have:
 - a. 5-day meal plan
 - b. 7 -day meal plan
 - c. Block of meals
 - d. Commuter meal plan
 - e. I just purchase meals when I need them
 - f. I do not have a meal plan on campus

Section 2

For the remainder of this survey, use this definition: Cooking is the practice or skill of preparing food by combining, mixing, and heating ingredients

6. Who does the *majority* of the cooking for the meals you eat at home?
 - a. Myself
 - b. Roommates
 - c. Parents

- d. Other: _____
7. On average, how often do you cook a meal for yourself per week?
- Never
 - Monthly
 - 2-3 x per month
 - Weekly
 - 2-4 times per week
 - 4-6 times per week
 - Daily
8. Where do you *most* frequently purchase food:
- Grocery store (Example: Hornbachers, Cashwise, Walmart)
 - Convenience Store (Example Loaf & Jug, Tesoro, Casey's General Store)
 - Warehouse (Example: Sam's Club, Costco)
 - Other: _____
9. How do you usually get to the store to buy food?
- Personal car
 - In someone else's car
 - Bus/public transportation
 - Bike/walk
 - I don't buy food off-campus.
10. On average how often do you eat fast food or eat out? (Examples: McDonalds, Subway, Buffalo Wild Wings, Applebee's, Taco Johns, Pizza Hut, etc.)
- Never
 - Monthly
 - 2-3 x per month
 - Weekly
 - 2-4 times per week
 - 4-6 times per week
 - Daily
11. How many times a week do you eat frozen entrees, pizza, ramen noodles, or boxed entrees for meals?
- Never
 - Monthly
 - 2-3 x per month
 - Weekly
 - 2-4 times per week
 - 4-6 times per week
 - Daily

Food Preparation Frequency Score Questions

12. How often do you purchased fresh vegetables?

- a. Daily
- b. Weekly
- c. Monthly
- d. 1-5 times a year
- e. Never

13. How often do you prepare a green salad?

- a. Daily
- b. Weekly
- c. Monthly
- d. 1-5 times per year
- e. Never

14. How often do you prepare a dinner with chicken, fish or vegetables

- a. Daily
- b. Weekly
- c. Monthly
- d. 1-5 times per year
- e. Never

15. How often do you prepare an entire meal (more than one dish) for 1 or more people?

- a. Daily
- b. Weekly
- c. Monthly
- d. 1-5 times per year
- e. Never

Dietary Intake Questions

16. In the past week, how many servings of fruit did you usually eat on a typical day? (A serving is a half-cup of fruit or 100% fruit juice, or a medium piece of fruit.)

- a. Zero servings per day
- b. Less than 1 serving per day
- c. 1 serving per day
- d. 2 servings per day
- e. 3 servings per day
- f. 4 servings per day
- g. 5 or more servings per day

17. In the past week, how many servings of vegetables did you usually eat on a typical day? (A serving is a half-cup of cooked vegetables or one cup of raw vegetables.)

- a. Zero servings per day
- b. Less than 1 serving per day
- c. 1 serving per day
- d. 2 servings per day

- e. 3 servings per day
 - f. 4 servings per day
 - g. 5 or more servings per day
18. In the past week, how many servings of whole grains did you usually eat on a typical day? (1 serving is 1 slice 100% whole wheat bread, 1/2 cup cooked brown rice or whole wheat pasta, 1/2 cup cooked hot oatmeal, 1 cup 100% whole grain cold cereal).
- a. Zero servings per day
 - b. Less than 1 serving per day
 - c. 1 serving per day
 - d. 2 servings per day
 - e. 3 servings per day
 - f. 4 servings per day
 - g. 5 or more servings per day
19. Over the past week, how many servings of low-fat dairy (low fat milk, cheese, yogurt) did you usually eat on a typical day? (1 serving is 1 cup skim or 1% milk, 1 low fat yogurt cup yogurt, 1 1/2 oz natural cheese, 1/2 cup cottage cheese)
- a. Zero servings per day
 - b. Less than 1 serving per day
 - c. 1 serving per day
 - d. 2 servings per day
 - e. 3 servings per day
 - f. 4 servings per day
 - g. 5 or more servings per day

Section 3

Think about your normal cooking and eating habits at home in the last month. Select the answer that is most consistent with your daily routine.

20. I make meals that require 3 or more ingredients.
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Often
 - e. All of the time
21. When I plan to cook a meal, I make a grocery list.
- a. Never
 - b. Rarely
 - c. Sometimes
 - d. Often
 - e. All of the time
22. I plan food for the week (menu plan).
- a. Never

- b. Rarely
- c. Sometimes
- d. Often
- e. All of the time

23. When cooking, I can follow a recipe from start to finish.

- a. Never
- b. Rarely
- c. Sometimes
- d. Often
- e. All of the time

24. I create meals from scratch without convenience food ingredients.

- a. Never
- b. Rarely
- c. Sometimes
- d. Often
- e. All of the time

Section Four

Attitudes toward Cooking

25. Think about how you feel about the following statements and please select the best answer.
(Strongly Agree, Agree, Disagree, Strongly Disagree)

	SA	A	D	SD
Cooking helps you eat more healthfully				
Cooking is hard				
Cooking takes too much time				
I like to cook				
I feel confident in my various cooking techniques				
Cooking is expensive				
Cooking is time consuming				

Perceived Cooking Skills Score Questions

26. Check the box that best describes how you feel about your ability to do the following statements
when you cook or prepare a meal

Not Confident *Somewhat Confident* *Confident* *Very Confident*

Using herbs and spices

Following a recipe

Using knife skills in the kitchen (chopping, mincing etc).

Using an oven/stovetop

Using a Crockpot/slow cooker

Using a blender or food processor

Preparing fresh or frozen vegetables

Cleaning and cutting fresh fruit

Cleaning, preparing, and cutting up a head of lettuce

Preparing eggs

Sautéing

Stir Frying

Braising

Grilling and Broiling

Steaming

Roasting Meat and Vegetables

Baking

Preparing Rice

Cooking Beans/Legumes

APPENDIX C. STUDY INFORMED CONSENT

NDSU

North Dakota State University

Health, Nutrition and Exercise Sciences

E. Morrow Lebedeff Hall 351 Dept 2620, PO Box 6050

Fargo, ND 58108-6050

701- 231-7479

Title of Research Study:

Relationships among diet quality, BMI, and cooking skills among college students

This study is being conducted by:

Sherri Stastny, PhD, RD, CSSD, LRD, Associate Professor sherri.stastny@ndsu.edu

Jenna Kourajian, RD, LRD, Graduate Student, jenna.kourajian.1@ndsu.edu

Why am I being asked to take part in this research study?

This study is being conducted to examine how cooking skills are related to BMI and diet quality among college students.

What is the reason for doing the study?

The researcher aims to look at perceived cooking skills among young adults and the relationship to a healthy weight/BMI and dietary patterns. This study may be used in the future to create programs and classes to improve knowledge in cooking skills to promote healthy eating.

What will I be asked to do?

You will be asked to fill out a survey about your dietary habits and cooking skills/techniques. You will also be asked questions regarding your living situation, sex, height and weight to calculate Body Mass Index (BMI).

Where is the study going to take place, and how long will it take?

The survey will be completed online using “Qualtrics”. It should take less than 10 minutes to complete. To complete the survey, please click on the link below.

What are the risks and discomforts?

This research study has very little risk. The survey results will be kept confidential within the survey team, but loss of confidentiality is a risk. It's not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known risks to the participant.

What are the benefits to me?

You are not expected to get any direct benefit from being in this research study.

What are the benefits to other people?

The overall benefit for this study may be to identify cooking skills or behaviors of young adults to determine if these skills relate to having a better diet and having a healthy weight. By identifying these behaviors, appropriate interventions and programs to address the problem and improve the health of young adults can be developed.

Do I have to take part in the study?

Your participation in this research is your choice. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

What are the alternatives to being in this research study?

Instead of being in this research study, you can choose not to participate.

Who will see the information that I give?

Only the research team may have access to your personal data. We will keep all research records that identify you private. Your information will be combined with information from other people taking part in the study. When we write about the study, we will write about the combined information that we have gathered. We may publish the results of the study; however, we will keep your name and other identifying information private.

What if I have questions?

Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, you can contact the researcher at 701-341-8929 or jenna.kourajian.1@ndsu.edu or Sherri Stastny at 701-231-7479 or sherri.stastny@ndsu.edu.

What are my rights as a research participant?

You have rights as a participant in research. If you have questions about your rights, or complaints about this research you may talk to the researcher or contact the NDSU Human Research Protection Program by:

- Telephone: 701.231.8908 or toll-free 1.855.800.6717
- Email: ndsu.irb@ndsu.edu
- Mail: NDSU HRPP Office, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050.

The role of the Human Research Protection Program is to see that your rights are protected in this research; more information about your rights can be found at: www.ndsu.edu/irb .

Documentation of Informed Consent:

You are freely making a decision whether to be in this research study.

1. You have read and understood this consent form
2. You had your questions answered, and you have decided to be in the study

APPENDIX D. EMAIL INVITATION

North Dakota State University

Health, Nutrition, & Exercise Sciences

NDSU Dept 2620

PO Box 6050

Fargo, ND 58108-6050

701.231.7479

Jenna Kourajian, RD, a graduate student in the Department of Health, Nutrition, and Exercise Sciences at North Dakota State University, is seeking participants for a study on the relationship among cooking skills, diet quality, and BMI in college students.

This study is intended to broaden the understanding of cooking skills in young adults in relation to healthy dietary patterns and a healthy weight. We hope to get a better understanding of this relationship to develop possible interventions for future programs from the results of this study.

The study involves completing a 10-15 minute survey on cooking skills, knowledge and dietary patterns. The survey will be anonymous and your name will not be linked to survey. Thank you for your participation. If you have any questions about this project, please contact me at (701) 231-9615 or jenna.kourajian.1@ndsu.edu or my advisor sherri.stastny@ndsu.edu or (701) 231-7479.

This study is conducted through North Dakota State University, Fargo, ND. Participation is voluntary and all information collected will be kept strictly confidential. If you have questions about the rights of human research participants, you may contact the NDSU IRB Office, 701-231-8908.

To proceed to the study, please click here:
[Take Survey.](#)