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Niles, Erin. *Estimating Portion Sizes Based on the MyPlate Graphic*

Abstract

The growing trend in portion sizes is an issue currently plaguing our nation. The replacement of the MyPyramid model with the release of the MyPlate graphic aims to give the general public a better understanding of how meals should be constructed. Objectives of this study were to determine if the college students were able to understand the concept and correctly identify portion sizes from examining the MyPlate graphic. Two hundred twenty four total students participated in the online survey, and results showed that students were able to effectively use the graphic to estimate portion sizes. Student were also able to correctly identify the overall concept of the graphic, but the data regarding the graphic inspiring students to do further research on portion sizes was inconclusive. Further research on the usefulness of the MyPlate graphic is warranted.

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Chapter I: Introduction

Over the past 30 years the portion sizes consumed by the average American have nearly tripled in size (Nielsen & Popkin, 2003). This increase in portion sizes directly correlates with the rising rates of obesity in the United States (Nestle, 2003; Rolls, Morris, & Roe, 2002). Portion size distortion may be occurring because many food manufacturers are not in compliance with the Food and Drug Administration's regulation that serving sizes should be reflecting a typical amount that the consumer would eat (FDA, 2004). Another issue in need of further study is the ability of the average consumer to accurately estimate a correct portion size that has been designated by the USDA's 2010 Dietary Guidelines for Americans (USDA Center for Nutrition Policy and Promotion, 2011). The fact that many individuals do not realize that the portion size of food being consumed is often double the recommended serving size may be one of the key contributing factors to more than two-thirds of Americans being overweight (USDA Press Release, 2011).

The 2010 Dietary Guidelines for Americans are based on scientific information and research findings in order to provide authoritative advice on proper dietary habits (USDA, 2010). The goal of the guidelines is to enhance health and reduce the risk for chronic disease. These guidelines emphasize an increased focus on using physical activity to balance calories, consuming more fruits and vegetables, whole grains, low-fat and fat-free dairy products, and more seafood. In turn, recommendations are set to give Americans the ability and information to make healthier food choices and to select food choices within the correct portion sizes. It is recommended that in order to live the healthiest lifestyle possible, all Americans should follow the Dietary Guidelines (USDA Press Release, 2011).

Along with these guidelines came the release of more consumer-friendly tools. One of the tools is the replacement of MyPyramid with a completely new model known as MyPlate. While the first official USDA food guide was released in 1917, the emphasis of this guide was on vitamins, and five main food groups that were identified: milk and meat, cereals, vegetables and fruits, fats and fatty foods, sugars and sugary foods. Later the guidelines were promoted to the “Basic 7,” which separated milk from meat and vegetables from fruits. In 1956, the guidelines were still without a graphic for the consumers, but the food groups were revised back to milk, meat, vegetables and fruits, breads and cereals. The emphasis at this time was to ensure Americans ate enough food. As the waistlines of Americans grew increasingly larger, another category was added as a recommended limitation: fats, oils, and sweets. In 1992, the first debut of a graphic appeared, which was known as the Food Guide Pyramid. The categories for this graphic included: 1) milk, yogurt, cheese, 2) meat, poultry, fish, dry beans, eggs, and nuts, 3) vegetables, 4) fruits, and 5) bread, cereal, rice, and pasta (USDA, 1993). The revision of the Food Guide Pyramid into MyPyramid in 2005 gave the consumer a sideways version of the pyramid with a figure to represent exercise. This graphic also promoted the use of online resources; MyPyramid.gov became yet another tool to further understand the specific meaning behind the graphic.

MyPlate is now the latest version of a graphic to guide consumer’s food choices. This icon was developed to promote healthy eating in regards to messages based on the 2010 Dietary Guidelines for Americans. This simplified version of the previous pyramid graphic is aimed at being a quick reference guide for the average American to model a meal. The plate is styled into four wedges representing fruits and vegetables, which comprise half the plate. Two other wedges are grains and protein, with each representing a quarter of the plate. Also, there is a circle off to

the right side of the main plate representing dairy (Fryxell, 2011). With the debut of this new version there have been both praise and criticism from consumers and professionals. While the main message behind the graphic is to make half your plate fruits and vegetables, essentially focusing the consumer to eat a more plant-based diet, it is still very open to interpretation (Vastag, 2011). The main question to be addressed is whether the consumer will be able to use the graphic as a quick reference guide to build a plate at meals without any specific portion sizes listed? Can this simple graphic work to guide our nation of ever increasing obese individuals to eat less and make better food and nutrition choices?

Statement of the Problem

This research contributes to the current body of knowledge with regards to the effectiveness of estimating portion sizes based on the MyPlate graphic. This research will help to determine if the MyPlate graphic is useful to college students in estimating portion sizes. Utilizing appropriate portion sizes has the potential to correct overeating and reducing obesity rates in the United States. Overall, this is the first research being performed on a college population's interpretation of the MyPlate graphic and will be beneficial to possible future modifications of the graphic itself.

Purpose of the Study

The purpose of this study was to determine if students attending the University of Wisconsin-Stout in Menomonie, Wisconsin during the spring of 2012 would be able to correctly determine portion sizes for various food items by only observing the MyPlate graphic. This study also attempted to determine if students were able to interpret the overall concept of the new graphic. This research was done through the use of an online survey and administered via student email.

Study Objectives

The 2010 Dietary Guidelines for Americans document includes tips for consumers in order to better interpret the guidelines themselves. The tips are found at choosemyplate.gov and are essentially represented within the graphic itself. The three main tips are “Enjoy your food, but eat less,” “Avoid oversized portions,” and “Make half your plate fruits and vegetables” (USDA, 2011). The purpose and objectives of this study was to assess if a population of college students will be able to correctly interpret these underlying tips from just the graphic, along with correctly identifying the portion sizes for various food items within the food groups represented on the graphic. The specific objectives for this study were:

1. Verify if college students are able to determine correct portion sizes from the MyPlate graphic.
2. Determine if college students are more likely to underestimate or overestimate portion sizes based on the MyPlate graphic.
3. Determine if the MyPlate graphic would initiate college students to do further research on correct portion sizes.

Definition of Terms

The following terms are defined for further clarification within this study.

Body mass index. A number calculated from a person’s height in meters and weight in kilograms. BMI provides a reliable reference indicator of body fatness for most people, and is used to place people into weight categories that may lead to chronic health conditions.

Choose MyPlate. MyPlate was developed to promote healthy eating to consumers. The MyPlate icon is used to promote messages based on the 2010 Dietary Guidelines for Americans.

This icon builds on an image of a plate and is accompanied by messages to encourage consumers to make healthy choices.

Dietary Guidelines for Americans. The guidelines provide authoritative advice for Americans ages 2 and older about consuming fewer calories, making informed food choices, and being physically active to attain and maintain a healthy weight, reduce risk of chronic disease, and promote overall health.

Energy-dense. According to the USDA definition, foods with a low nutrient density are high in calories and fat but offer relatively few essential nutrients. Doughnuts, regular sodas, potato chips, candy, and other processed snack foods and desserts have a high energy-density.

Nutrient-dense. The USDA defines nutrient-dense in relation to a food's caloric content. Foods that are high in vitamins, minerals and other nutrients but low in calories qualify as nutrient-dense foods. Many nutrient-dense foods, such as fruits and vegetables, are high in volume. These foods mostly contain water and fiber but are low to moderate in calories.

Obese. An adult with a BMI of 30 or higher would be considered obese (CDC, 2012c).

Overweight. An adult with a BMI between 25 and 29.9 would be considered overweight (CDC, 2012c).

Portion size. The amount of one food item that an individual chooses to eat.

Serving size. According to the U.S. Department of Agriculture's Center for Nutrition Policy and Promotion (USDA, 2011), the serving size of a particular food is determined by the typical portion size as determined through surveys and the nutrient content of the food.

Assumptions and Limitations of the Study

Firstly, it was assumed that all students answered each question truthfully. Secondly, it was assumed that students took the survey without the use of other resources in regards to correct portion sizes for the various food items. Lastly, it was assumed that each participating student was familiar with the standard units of measure for food items, and that each participant was familiar with each of the food items used as examples for questions within the survey.

There are several limitations within this research. The first limitation was the lack of material on the effectiveness of the MyPlate graphic because of its recent release to the public. A second limitation was that participants had the ability to research the correct responses to the survey questions while completing the survey. This would skew results in favor of the effectiveness of the graphic. Another limitation of this research was that if students were not familiar with the units of measure for the food items or with the food items, this could have led to participants randomly guessing from the given answers. This would skew results in favor of the ineffectiveness of the graphic.

Chapter II: Literature Review

This chapter will discuss five main topics in regards to the background information needed for this study. The topics to be covered in this chapter include portion sizes, the MyPlate graphic, estimating portion sizes, nutrition in the college population, and nutrition at the University of Wisconsin-Stout.

Portion Sizes

The conditions of overweight and obesity in the United States have increased dramatically over the past several decades. Nearly 97 million adults in the United States are currently considered overweight or obese (National Heart Lung and Blood Institute, 2011). The number of states with an obesity prevalence of 30% or more has increased to 12 states, whereas in 2000 no states had a prevalence of 30% (CDC, 2012b). Obesity-related conditions include heart disease, stroke, type II diabetes, and certain types of cancers. These are some of the leading causes of death in the US, and in 2008 the medical cost associated with the treatment of obesity-related diseases was estimated at \$147 billion (CDC, 2012a).

This increase in overweight and obesity is paralleled by the increase in the portion size of foods (Nestle & Young, 2007). Remarkably, portion sizes at restaurants, supermarkets, and at home have increased by fifty percent between 1977 and 1996, and still continue to grow (Neilson & Popkin, 2003). A portion is generally defined as the amount of a specific food item that a person eats during a meal or snack. Portions can vary depending on the needs of an individual, and can also vary from the suggested serving size of that item (Hogbin, Shaw, & Anand, 2001). Over the past three decades, portion sizes have become increasingly larger than reference serving sizes that are defined by United States federal agencies (CDC, 2012a). Also, 38% of Americans report eating out at least once per week and 25% eat out every 2-3 days. Overall intake of food

consumed away from the home has increased from 18% to 32%, and these foods consumed away from the home tend to be more energy-dense, larger, and nutritionally poorer. This fact is thought to be a direct contributor to the prevalence of overweight and obese people (Stewart, Blisard, & Jolliffe, 2006). The current environment in the US is one that promotes excessive food intake and large portion sizes consisting of energy-dense foods. In this culture the increase in energy intake is not compensated by eating less at a later time, which is leading to an obesity epidemic (Vermeer, Steenhuis, & Seidell, 2009).

A 2009 study performed by Vermeer, Steenhuis, and Seidell examined consumer behaviors towards increased portion sizes over the past three decades and the individuals' attitudes towards community-based interventions to combat large portions. The study used a focus group consisting of 49 respondents, and in general, participants stated that portion sizes are larger than what is required for satisfactory food intake. Participants also suggested that many companies seem to advertise large portion sizes as the norm within society. Many comments were made about supermarkets selling items in sizes that are more suitable for families than for single or two person households; although it was mentioned that there was a better value in buying these larger items. A majority of the participants also commented that restaurant portions are larger than what would be served at home, and that small portions of vegetables are served compared to the portions of meat being served. The focus group concluded with the general consensus that large portion sizes have become the norm, and when served a recommended serving size, many considered the portion as very small.

Further evidence of growing portion sizes in the United States was supported by the 2003 study done by Nielsen and Popkin. This study examined various food category increases in portion sizes in regards to an increase in both kilocalories and weight in ounces. It was stated that

between 1977 and 1996 the average portion size of salty snacks increased from 132 to 225 calories and from 1.0-1.6 oz., respectively. Soft drinks increased from 144 to 193 calories and from 13.1 to 19.9 fl oz., respectively. This was the trend for all food categories examined including desserts, fruit drinks, cheeseburgers, and Mexican food. This increase was found to be significant both at home and at restaurant establishments. The findings of this study are extremely significant to society; even just an extra 10 calories per day consumed can lead to an extra pound of weight gained per year.

Overall the increase in portion sizes and the rise in obesity levels in the United States have paralleled each other for several decades, and current community intervention strategies are geared towards correcting both of these issues. The Center for Disease Control's (CDC) Division of Nutrition, Physical, Activity, and Obesity is currently funding 25 states to address the issues of reducing obesity rates and promoting healthier lifestyle choices (CDC, 2012d). There is also a division of the CDC, Common Community Measures for Obesity Prevention Project Team, which is responsible for developing community intervention policies aimed at a healthier lifestyle. A recent proposal by this project team suggested that local governments develop policies to limit portion size of entrée items by either reducing the standard portion size or offering smaller sizes in addition to other standard portion size options. It is thought that this policy might prompt communities to make better choices through the use of better options available to the public (Khan et al., 2009).

Estimating Portion Sizes

Several studies have illustrated that most people do not have the ability to estimate correct portion sizes, and an increase in portion size directly leads to an increase in consumption. One particular study performed depicted that portion size influences hunger and satiety, and

when subjects were offered bigger portions, a larger amount of food was consumed before satiety was reached. There were 51 overweight and normal weight participants, and each subject came to a laboratory on four separate occasions to eat macaroni and cheese. During these visits each participant was presented with a portion size of 500, 625, 750, or 1000 grams. Participants were then divided into two groups, one group received pre-portioned dishes and the other group received a serving dish to take the desired amount. Participants consumed 30% more calories when presented with the largest portion, compared to when the smallest portion was offered. Participants were also asked to report hunger and satiety throughout the experiment. Similar ratings of hunger and satiety were given among the groups, despite the sizes of portions presented at each meal. Of all participating subjects, 45% reported not even noticing a difference in the portion size. This study also indicated that it made no difference if subjects served themselves or had portions predetermined; the amount consumed still increased as portion sizes enlarged. Results exhibited that most people are unaware of what an appropriate portion size should consist of, and energy intake can be directly influenced by the amount of food presented at a single meal (Rolls, Morris, & Roe, 2002).

In 2006, Schwartz and Byrd-Bredbenner examined several factors with regards to portion size selection in young adults. Objectives of this study were to determine typical portion sizes that young adults select, how these typical portion sizes compared to actual serving sizes, and if the size of one's typical portion changed over time. There were 177 subjects participating in this study, and subjects served themselves typical portion sizes of eight various foods at breakfast and six foods at lunch or dinner. Subjects serving themselves a portion within a range of 25% larger or smaller than an actual serving size were given one point whereas items served outside of this range were given zero points. The results of this study showed that typical portion sizes

selected by the subjects were significantly different from actual serving sizes. There was also a significant difference between the results of this study and a similar study conducted twenty years ago, indicating the increase in portion sizes over time among young adults. This study indicates that young adults have the need to better recognize and identify appropriate amounts of food to consume at mealtimes.

Another study done on young adults examined the ability of college students to estimate portion sizes from the Food Guide Pyramid. The purpose of the Food Guide Pyramid was to guide consumers to make healthy food choices, but appropriate serving sizes were not included. This fact alone undermined the actual utility of the Food Guide Pyramid, especially when the culture of the United States has witnessed a booming increase in portion sizes and a decrease in the ability of people to recognize proper portion sizes (Knaust & Foster, 2000). The purpose of the study was to determine the use of the Food Guide Pyramid as a teaching tool in regards to serving sizes. A survey was given to 148 college students. Two questions about serving sizes for each food group were included for a total of ten questions. A score of 10 indicated all correct responses, and actual scores ranged from 0-7. The average score for men was 2.2 and the average score for women was 3.3.

Knaust and Foster (2000) concluded that students in general are unaware of appropriate serving sizes. Even though the Food Guide Pyramid was available during the survey, students were not able to accurately answer survey questions (Knaust & Foster, 2000). This study was not designed to examine the significance of over or underestimation of serving sizes, but this may be interesting for future research opportunities, especially in regards to the newly introduced MyPlate. The study supports the idea that even the reference guide for food and nutrition intake provided by the governing agencies was not adequate to estimate proper portion sizes. The

ability of the general public to estimate portion sizes that are appropriate needs to be improved and further research is needed.

Within the past ten years there has been significant empirical evidence to support the fact that larger portions lead to increased energy intake. This lack of consideration for adequate portion sizes has been proven regardless of perceived taste, pre-portioned amounts, or satiety cues. These large portions of energy-dense foods are especially problematic because the increased consumption is generally associated with weight gain. This leads into the theory of portion distortion, which can be defined as the phenomenon of perceiving large portion sizes as appropriate amounts to eat at a single eating occasion (Vermeer, Steenhuis, & Seidell, 2009). The difficulty most people have with assessing larger than normal portion sizes has been proven by various studies. It can also be difficult for people to learn to compensate for eating large portion sizes if there is not an awareness of the initial portion size difference when food is being consumed (CDC, 2012e).

Although there is information available on proper serving sizes, many people are still consuming larger than normal portion sizes, and are not able to adequately assess the amount being consumed. The research compiled on successful methods used to estimate appropriate portion sizes is limited. In the study done by Young and Nestle (2003), it was concluded that individual characteristics of people such as gender, age, body weight, and level of education cause many of the differences in estimating portion sizes. Another confounding factor found by this study was that a person's natural satiety cues can be easily ignored depending on other external cues such as presented or pre-portioned size, access to food, and other sensory cues. Overall further research is needed to expand the evidence of individual's inability to estimate portion sizes and corrective actions that are needed.

MyPlate

In January of 2011 the USDA and the Department of Health and Human Services announced the release of the 2010 Dietary Guidelines for Americans. The guidelines were released at a time when the majority of adults are considered overweight or obese. These guidelines place a stronger emphasis on reducing calorie consumption by avoiding oversized portions and enjoying food but eating less of it (Dietary Guidelines for Americans, 2010). This release prompted the USDA to release a new visual guide aimed at promoting the message of the 2010 Dietary Guidelines.

The iconic Food Guide Pyramid graphic was replaced by the MyPlate icon in the summer of 2011 (USDA, 2011). (See Figure 1 for the MyPlate graphic). The image was designed to be as simple and user-friendly as possible for the American public. Nearly 4,500 Americans participated in focus groups to assist in designing the image and educational materials. Everything from the graphic to the material on the website was developed by a panel of dietitians, economists, and policy experts at USDA (USDA, 2011). The basis of the icon is a familiar image, a plate, with color-coded wedges symbolizing food groups. The wedges include a green wedge representing vegetables, a red wedge for fruits, purple wedge for protein, an orange wedge for the grain group, and a blue circle off to the side to represent dairy. The plate is accompanied by the message “*Make half your plate fruits and vegetables,*” promoting a plant based diet along with portion control, and the website address, ChooseMyPlate.gov below the plate.

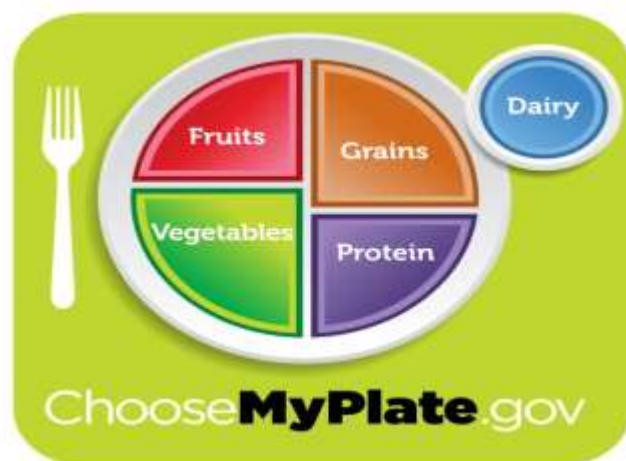


Figure 1. MyPlate (USDA, 2011)

The MyPlate image has been praised for its usability and promotion of the concept of increasing fruits and vegetables. With the praise has also come the criticism. For example, the lack of representation on MyPlate of several variables which were expressed in the 2010 Dietary Guidelines is lamented. The previous MyPyramid graphic had an individual climbing stairs to represent physical activity. Physical activity was omitted from the MyPlate design in order to simplify the image. The plate is also lacking information regarding which types of foods fit into each category, such as choose more whole grains, lean proteins, or a representation for healthy fats (Fryxell, 2011).

One of the plate's biggest criticisms is the lack of the promotion of portion control. It has been well documented that the average American does not realize that the portion of food being consumed is usually much larger than the recommended serving size (USDA Press Release, 2011). On average the USDA recommends the intake of 2 cups of fruits, 2.5 cups of vegetables, 6 ounces of grains, 5.5 ounces of protein, and 3 cups of dairy. Although this is not necessarily apparent from the graphic itself, the consumer must further investigate portion sizes by visiting ChooseMyPlate.gov. Overall the MyPlate graphic is to serve as a guide. All information

regarding portion size, physical activity, fiber, sodium, and other nutrients such as fat is found at the website designated under the graphic. Nutrition experts believe that this can be looked at as a step in the right direction, but now it is up to the public to interpret the icon and make modifications as needed (Fryxell, 2011).

Nutrition in the College Population

Adequate nutrition in a college population is a topic that has not been extensively studied; studies that have been done all reveal that the typical college student is not in compliance with dietary guidelines or recommended dietary allowances (The Premiere Student Health Survey, 2011). The intake of several foods including chicken, turkey, eggs, cheese, milk, and cereals, tend to increase in the college population compared to the diet consumed in a home setting (Stefanikova, Sevikova, Jurkovicova, Sobotova, & Aghova, 2006). Over 50% of college freshman and sophomores were found to not be consuming adequate fruits, vegetables, fiber, or calcium. About 60% of these students had diets high in saturated fat, and 59% reported that both diet and health had declined since starting college. Influential barriers to nutritional eating in a college population in the order of influence include: taste, lack of time, the need for convenience items, and low budgets (House, Su, & Levy-Milne, 2006).

Over 68% of Americans eat out at least once per week, but it has been reported that college students eat at least one meal from a fast food restaurant up to 6 times in one week. The foods consumed from fast food restaurants are lacking many nutrients, yet provide very energy-dense food when eaten on a consistent basis and can directly contribute to weight gain (Driskell, Kim, & Goebel, 2005). A 2003 study examined the impact of fast food consumption on dietary patterns of 17,370 adults and children. Participants of this study who reported eating fast food on a regular basis had higher overall energy, fat, and sodium intakes. Intakes of vitamins A and C,

fruits, vegetables, and milk were lower among this group (Paeratakul, Ferdinand, Champagne, Ryan, & Bray, 2003). This further contributes to the body of research that frequent fast food consumption can impact nutritional well-being and may also contribute to the overall poor nutritional status of the college population.

Nutrition at the University of Wisconsin-Stout

In 2010 the state of Wisconsin was one of 36 states that had an obesity rate higher than 25%. In 2010, the total of those classified as overweight and obese in Wisconsin was 63.6% according to the CDC's Behavioral Risk factor Surveillance System (CDC, 2012b). The University of Wisconsin-Stout is located in Dunn County where the prevalence of overweight and obesity is 29.2% (CDC, 2012b). This prevalence for college students in Dunn County is less than the national average. The American College Health Association reported that some 34.1% of college students are considered overweight or obese according to the Body Mass Index (National College Health Assessment, 2011).

The University of Wisconsin-Stout Dining Services department is a resource for students to make healthier choices and utilize the on campus Registered Dietitian. Tools and resource links are accessible via the UW-Stout webpage and nutrient analysis and healthy menu planning tools are also available to students. Links to ChooseMyPlate.gov are also available along with interactive tutorials for the MyPlate graphic. According to Melissa Eierman, MS, RD, the campus registered dietitian, the number of students who took advantage of these services and resources included 23 students for 80 total sessions for the 2010-2011 school year. During the 2011-2012 school year, there were 33 students for a total of 97 sessions utilizing Melissa's services and resources. Students attending UW-Stout are notified of these resources during initial student orientation and via campus dining advertisements.

There appears to be a lack of research on portion knowledge of college students. This research will determine if college students at the University of Wisconsin-Stout are able to determine correct portion sizes from the MyPlate graphic and whether the college students are more likely to underestimate or overestimate portion sizes based on the MyPlate graphic.

Chapter III: Methodology

This chapter will include a description of the subjects, instrument, and software used within this study. The data collection procedures along with data analysis and limitations of this methodology will be detailed.

Sample Selection

Subjects in this study participated on a volunteer basis. No subject selection occurred until approval of the research was received from the University of Wisconsin-Stout Institutional Review Board Review (IRB) for the Protection of Human Subjects. (See Appendix A for memo of study approval). A random sample of about 18.5% of the student population (1,746 students) at the University of Wisconsin-Stout in Menomonie, Wisconsin was chosen to receive an email containing the link to the study survey. By clicking on the survey link participants agreed that the consent form (See Appendix B) had been read and the survey could be stopped at any time. There were no identifying factors collected of the study participants.

Instrumentation

The study survey was created by the researcher based on the instruments developed by Knaust and Foster (2000). The survey by Knaust and Foster aimed to determine if a college population could determine serving sizes from the Food Guide Pyramid. The survey designed by the researcher varied in several ways from the template of the Knaust and Foster survey. (See Appendix C for the survey). No identifying features were included in the survey such as questions regarding age, gender, or year in school. The survey consisted of 14 questions. Four questions were aimed to determine the level of familiarity and instruction with the MyPlate graphic. Two questions were used to determine if the sample surveyed was able to identify the overall message conveyed by the graphic, and five questions involved identifying correct portion

sizes for each food group represented on the MyPlate graphic. There was no available instrumentation previously developed to fit the needs of this study making this instrumentation designed by the researcher an original but non validated instrument.

Data Collection Procedures

A random sample of 18.5% of the University of Wisconsin-Stout student population received an email with the subject line “Settle the controversy with a 2 minute survey!” The email was sent from the Qualtrics Survey Software system, making the email from an anonymous source and selected subjects were unable to reply to the email. Within the email the informed consent and a statement regarding the protection of human subjects were provided. Once the subjects had read this content, participants were invited to click on the link provided at the bottom of the email. By clicking on the link the participants were redirected to the survey provided by the Qualtrics Survey Software system. Once the survey was started by the participant, a random response identification code was provided for each individual. When the survey was completed by the individual, results were stored within the Qualtrics data base and the subject’s participation was ended.

Data Analysis

Data analysis used within this study involved the use of frequencies. Several survey items were yes or no questions and these were analyzed using frequencies. Other items involved several answer possibilities. These items were evaluated on the basis of whether the item was answered correctly or incorrectly by the student participant. No other statistical analyses were completed on this research data.

This concludes the methodology utilized for this study on University of Wisconsin-Stout students. The results from the investigation are presented in Chapter 4.

Chapter IV: Results

This chapter will review the results of the study. The contents include demographic information and item analysis. Variables investigated included: the level of familiarity and instruction of the college students with the MyPlate graphic, a summary of student's ability to identify correct portion sizes for each food group represented on the MyPlate graphic, and the responses to what is the overall message conveyed by the graphic.

Demographic Information



The University of Wisconsin-Stout is a university with an enrollment totaling 9,356 (University of Wisconsin-Stout, 2012). The survey was distributed randomly via email to 1,746 students, which was about 18.5% of the total student population. There were a total of 224 surveys finished from this sample receiving the survey, making the total response rate 12.8%. Other identifiers such as age, gender, year in school were not collected or required for the purpose of this research.

Item Analysis

A total of 11 items on the survey were analyzed. Data are summarized from item one of the survey in Table 1. The question assessed the level of previous instruction the student had on how to use the MyPlate model. There were 75% of students who had no previous instruction with MyPlate, and 25% of students who had some type of instruction on the use of the model.

Table 1



Previous Instruction on how to use the MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	Yes		67	25%
2	No		197	75%
	Total		264	100%

Data from item two of the survey are summarized with Table 2. The question pertained to the student's awareness that MyPlate had replaced the Food Guide Pyramid. A total of 58% of students completing the survey were not aware that MyPlate had replaced the Food Guide Pyramid, compared to 42% who were aware of the change.

Table 2





Student's Awareness of MyPlate Model Replacing Food Pyramid

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	Yes		110	42%
2	No		154	58%
	Total		264	100%

Item three of the survey was aimed at the type of instruction the student had with the MyPlate model. The options included self-taught, class lecture, other, or no previous instruction. The data are represented in Table 3 and Figure 2. The largest response was in the no previous instruction category with 64% of the students.

Table 3

Extent of Instruction on MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	Self-taught		36	14%
2	Class lecture		48	18%
3	Other		10	4%
4	No previous instruction		170	64%
	Total		264	100%

As shown in Figure 2, the great majority of the respondents claimed no previous instruction on the MyPlate model. Some 36, 48 and 10 students claimed to be self-taught, received instruction from class lecture, or had other exposure to the model, respectively.

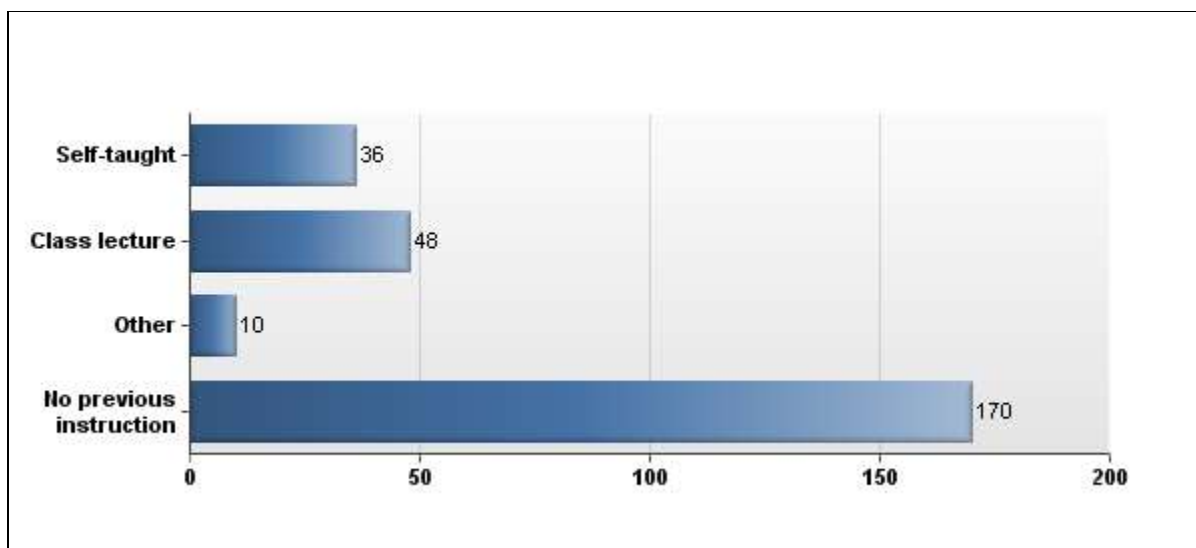







Figure 2. Extent of instruction on the use of MyPlate model

Survey items four through eight were aimed at student's ability to estimate actual portion sizes from viewing the MyPlate graphic. The questions included actual food items from each of the food groups represented on the MyPlate graphic. There was one correct answer for each food group, two answers with a smaller than recommended portion size, and two answers with a larger than recommended portion size. A summary of the data from survey items 4-8 can be found in the tables and figures below.

The dairy group question had the answer of 1 cup of milk, the recommended serving size, receiving 68% of responses. (See Table 4). The incorrect responses of 1/3 cup, 1/2 cup, 1 1/2 cups, and 2 cups were selected by 4%, 12%, 7%, and 10% of the students, respectively. Figure 3 depicts the dramatic evidence that the majority (n = 163) either recognized 1 cup of milk as the serving represented by the icon or based their choice on past experiences with a dairy serving.

Table 4

Responses of Students for Portion Size of Dairy Group Based on the MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	1/3 cup milk		9	4%
2	1 1/2 cups milk		16	7%
3	2 cups milk		24	10%
4	1/2 cup milk		29	12%
5	1 cup milk		163	68%
	Total		241	100%

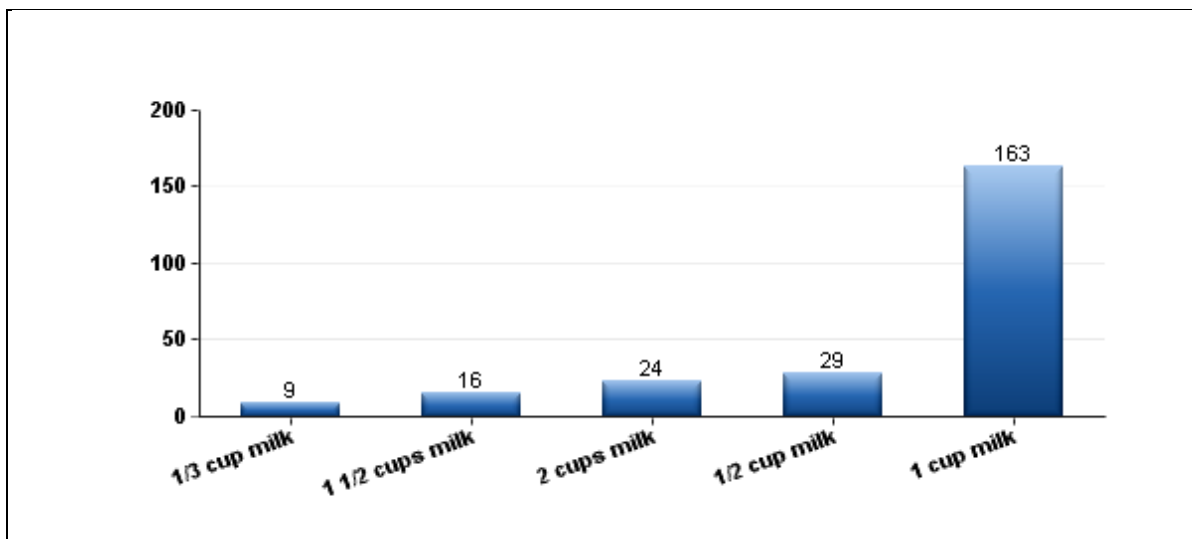


Figure 3. Number of responses of students when asked to select the recommended portion size of dairy group based on the MyPlate model

Table 5 depicts the choices of students when asked to select the correct portion size of the grain group based on the MyPlate model. Some 32% (78 responses) of participants choose 1 cup brown rice as the correct portion size followed by 28% (n = 68) of participants choosing the 1/2 cup option, which is the recommended serving.

Table 5

Responses of Students for Portion Size of Grains Group Based on the MyPlate Model






Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	1 cup brown rice		78	32%
2	1/4 cup brown rice		38	16%
3	1/3 cup brown rice		18	7%
4	1/2 cup brown rice		68	28%
5	1 1/2 cups brown rice		40	17%
	Total		242	100%

Figure 4 graphs the information of choices of students when asked to select the correct portion size of the grain group based on the MyPlate model. The figure illustrates that there was a noticeably similar number selecting the 1 cup and 1/2 cup choices. If 1 cup was selected for a meal, this doubles the calories received in the rice serving.

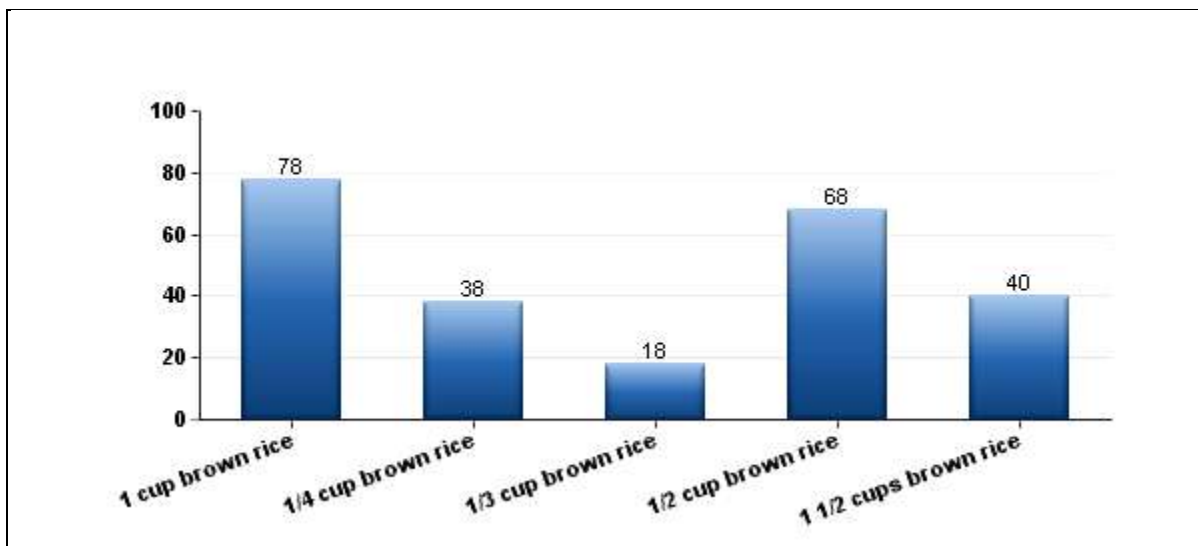







Figure 4. Number of responses of students for portion size of grains group based on the MyPlate model

Forty-five percent of participants ($n = 104$) chose 3 ounces of chicken to be the correct serving size, which is the recommended serving size, and 33% ($n = 77$) of participants chose 6 ounces of chicken as the correct serving size when presented with the MyPlate model (see Table 6 and Figure 5). Some 13% ($n=29$) chose 2 ounces of chicken.

Table 6

Responses of Students for Portion Size of Protein Group Based on the MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	3 ounces of chicken		104	45%
2	2 ounces of chicken		29	13%
3	6 ounces of chicken		77	33%
4	1 ounce of chicken		5	2%
5	8 ounces of chicken		17	7%
	Total		232	100%

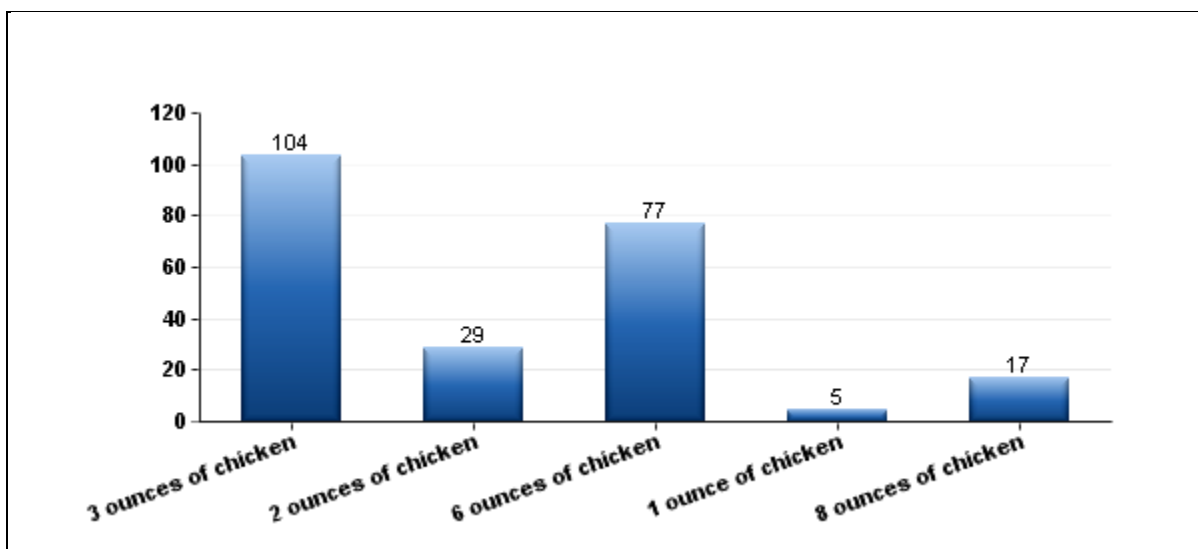







Figure 5. Number of responses of students for portion size of protein group based on the MyPlate model

Seventy-four respondents (32%) correctly chose 1 cup of raw cauliflower as the serving size for the vegetable group when presented the MyPlate model (See Table 7). As depicted in Figure 6, the responses of 1 cup and the one and half cup of cauliflower were similarly chosen, which may indicate the larger wedge devoted to the vegetable group on the MyPlate icon may have influenced the larger serving size choice by the participants.

Table 7

Responses of Students for Portion Size of Vegetable Group Based on MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	1/3 cup raw cauliflower		15	7%
2	1 cup raw cauliflower		74	32%
3	1/2 cup raw cauliflower		38	17%
4	1 1/2 cups raw cauliflower		66	29%
5	2 cups raw cauliflower		37	16%
	Total		230	100%

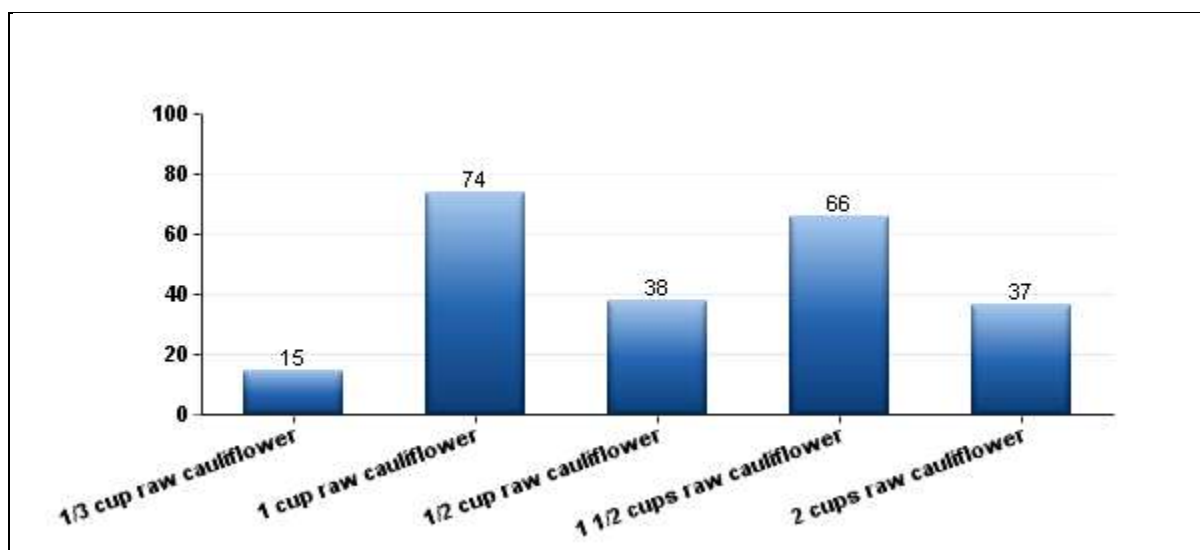







Figure 6. Number of responses of students for portion size of vegetable group based on MyPlate model

Table 8 depicts 89 participants (39%) chose 1/2 cup of sliced strawberries as the correct portion size from the fruit group, and 69 (31%) that chose the recommended portion of 1 cup. Figure 7 dramatically depicts the responses which may be an attempt to match the serving to the small wedge on the MyPlate model or may represent the present consumption patterns of participants eating at home or at restaurants in which the portions are often 1/2 or even 1/3 cup.

Table 8

Responses of Students for Portion Size of Fruit Group Based on MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	1 1/2 cups sliced strawberries		12	5%
2	2 cups sliced strawberries		14	6%
3	1 cup sliced strawberries		69	31%
4	1/2 cup sliced strawberries		89	39%
5	1/3 cup sliced strawberries		42	19%
	Total		226	100%

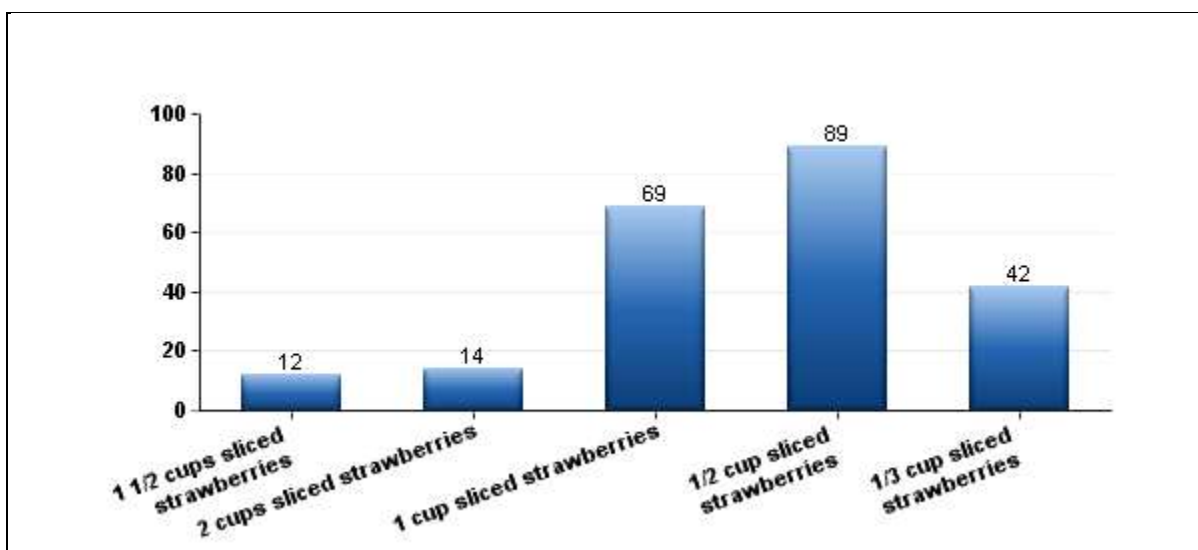




Figure 7. Number of responses of students for portion size of fruit group based on MyPlate model

Item nine on the survey was aimed at determining if the MyPlate model made students interested in doing further research on the representation of the model in regards to portion sizes of the food groups represented. A summary of these responses are represented below in Table 9. Fifty three percent of respondents did want to further research the MyPlate model and 47% were not interested in further researching the model.

Table 9

Responses of Students to Further Research the Representation of MyPlate Model

Choice #	Answers	Horizontal Graphs	Responses (n)	%
1	Yes		121	53%
2	No		106	47%
	Total		227	100%

Survey items 10 and 11 were intended to assess the ability of college students to understand the main concept behind the MyPlate graphic. The notion of the graphic is to make one's plate half fruit and vegetables. Essentially fruits and vegetables should be the main components at every meal if the graphic is interpreted correctly. These final two questions were filtered from the rest of the survey depending on the participant's response in question 1. Only those who had no previous instruction with the MyPlate model were included in the responses for question 10 and 11. This dropped the number of participants from 224 to 166 for the final two survey items. Question 10 from the survey asked students to pick the main concept of the plate with regards to the wedges representing the food groups. Table 9 shows that 113 respondents (68%) chose that the main concept of the plate was to make half the plate fruit and vegetables.

Table 10

*Responses of Students for Interpretation of the Main Concept of Food Groups for MyPlate**Model*

#	Answers	Horizontal Graphs	Responses (n)	%
1	Make half your plate fruit and vegetables		113	68%
2	Make half your plate protein and grains		24	14%
3	Make half your plate fruit and grains		4	2%
4	Make half your plate vegetables and protein		25	15%
	Total		166	100%

Figure 8 depicts Question 10 in even more visual detail. Question 10 asked students to pick the main concept of the MyPlate graphic with regards to what message was conveyed by the wedges. An overwhelming number selected the choice the graphic intended to convey, which was to “Make half your plate fruit and vegetables.”

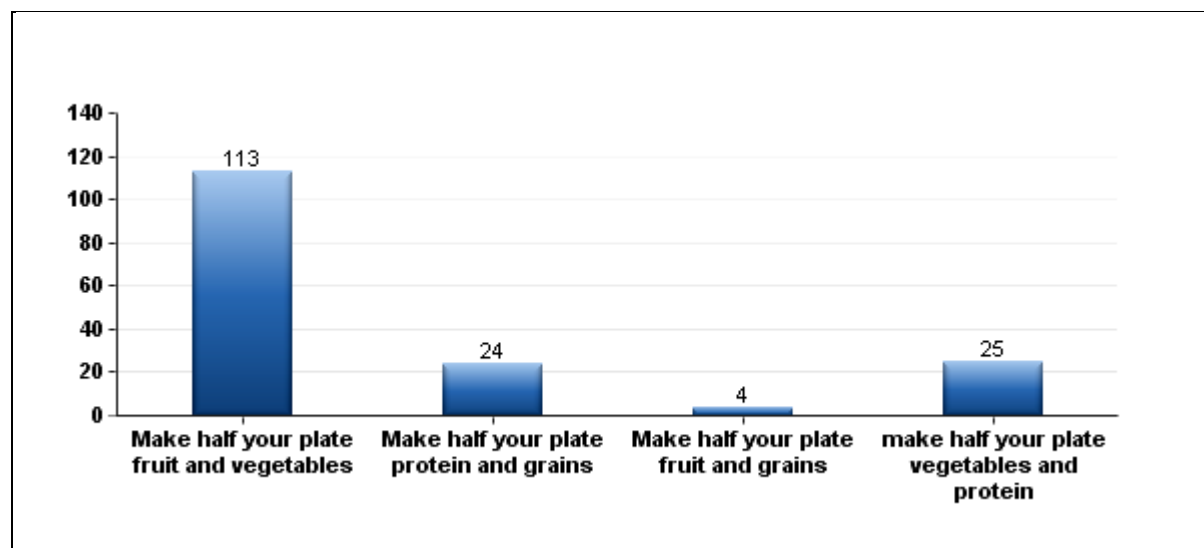


Figure 8. Number of responses of student’s interpretation of the main concept of food groups for MyPlate model

Item 11 posed the question of interpreting the main concept of the MyPlate icon a bit differently. This question asked if the main concept of the MyPlate model was to include all five food groups, make half the plate fruits and vegetables, or if the size of the plate was the most important component. Including all five food groups received 79% of the responses, which means that 131 of the participants chose this answer. This answer was overwhelmingly picked instead of the intended intent of the graphic which was to make fruit and vegetables the largest component of the plate.

Table 11

Responses of Students to Interpretation of the Main Concept of MyPlate Model when the Option of 5 Food Groups in each Meal was Included




Choice #	Answers	Horizontal Graphs	Responses	%
1	Include 5 food groups in each meal		131	79%
2	Fruits and vegetables should be the largest components of the plate		27	16%
3	The size of the plate is the most important factor		7	4%
	Total		165	100%

Figure 9 shows the noticeably higher selection of “Include the 5 food groups in each meal” as the purpose of the MyPlate model. Only 27 picked the response that fruits and vegetables should be the largest component of the plate, which was the intent of the graphic. This was a surprising finding but did reflect preliminary data collected from random individuals upon whom the survey was pre-tested. The MyPlate sponsors may be surprised that the overall most important meaning to uneducated consumers about the graphic is the message of including 5 food groups in each meal.

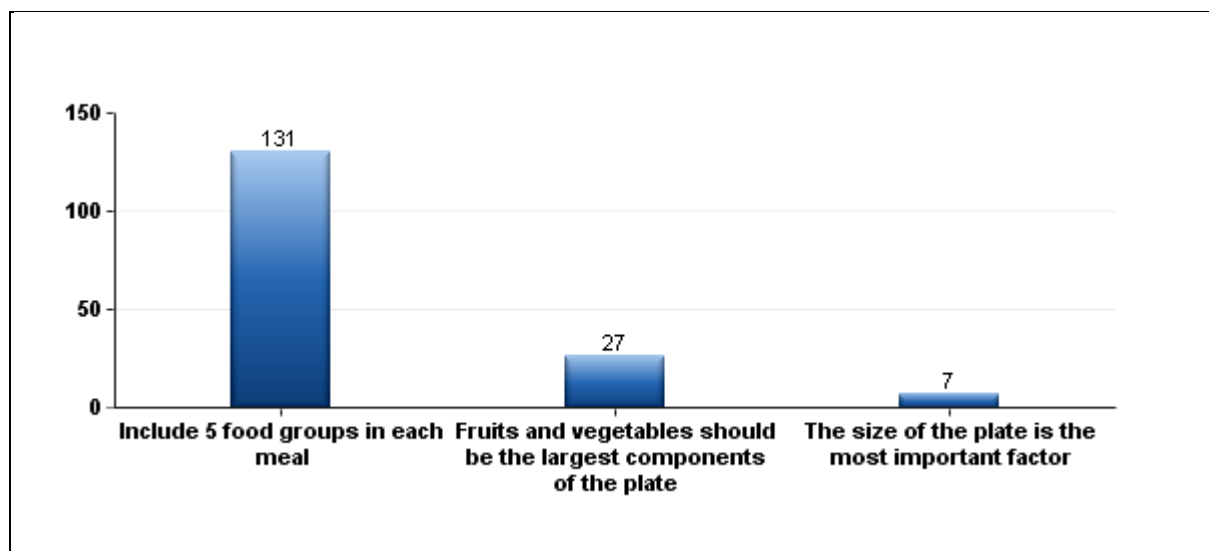


Figure 9. Number of responses of student’s interpretation of the main concept of MyPlate model when the option of 5 Food Groups in each meal was included

This concludes the data item analysis. The significance of the findings and comparisons to the literature will follow in Chapter 5 as well as limitations and recommendations for future research.

Chapter V: Discussion

This chapter will begin with a discussion of the results and how these results relate to the study objectives. This will be followed by conclusions drawn from the data, and recommendations for future research within this area of study.

Discussion

Objective number one of this study was to verify if college students could determine correct portion sizes from the MyPlate graphic. The objective was attained by surveying college students to determine when the MyPlate graphic was provided, would the model assist the students in identification of food group portion sizes. The data demonstrated that students were able to correctly identify portion sizes for two out of the five food groups. The largest percentage of correct responses out of all the food groups was for the one cup serving from the dairy group. This was the correct portion size, and 68% of students were able to identify this from the graphic. Students were also able to correctly identify a correct portion size from the graphic for the protein group. The correct portion size was three ounces, and this was identified by 45% of students. The six ounce portion size followed with 33% identifying this as the correct portion size.

Food group portion sizes that were not identified correctly were the grains group, fruit, and vegetable groups. Thirty two percent of students chose 1 cup of rice as the correct portion size after examining the MyPlate graphic. This was followed closely by 28% identifying 1/2 cup as the correct portion size, which was the actual correct answer. The correct answer for the vegetable group was 1 cup of raw cauliflower. This was identified by 32% of students, but the answer receiving the second most responses was 1 1/2 cups with 29%. The correct portion size

identified by MyPlate for the fruit group is 1 cup, although, 39% chose 1/2 cup. One cup followed with 31% of the responses.

The second objective of this study was to determine if students were more likely to over or under estimate portion sizes based on the MyPlate graphic. In the survey administered to students, each question included the correct response and two options that were underestimations and two options that were overestimations. From this it was determined if students over or under estimated portions sizes. Three of the five food groups did not receive a majority of the correct responses. Forty nine percent over estimated the portion size of the grain group, while 28% chose the correct option. That leaves the fruit and vegetable group, which had differing responses. The vegetable group received an over estimation regarding correct portion size, and students underestimated the portion size for the fruit group.

The last objective of this study was also addressed by the survey question regarding if students felt the need to do further research about food and portion sizes after looking at the MyPlate model. Answers for this question were almost split in half with 53% answering yes to wanting to research the model further and 47% choosing not wanting to do more research. Students were also overwhelmingly able to identify the main concept of MyPlate based on the model. Sixty eight percent chose “Make half your plate fruits and vegetable” which is the main key consumer message portrayed by the graphic. Although when asked what was the main concept of the MyPlate model a second time, 79% of students chose “Include 5 food groups in each meal” as opposed to the correct response which was “Fruits and vegetables should be the largest components of the plate.” The correct response for this question was only chosen by 16% of study participants.

Conclusions

It can be concluded from this study that MyPlate is a useful guide to estimating portion sizes. College students were able to correctly identify the portion sizes for at least two of the five food groups, and were also able to correctly identify the overall concept of the graphic.

Conclusions that are drawn from the graphic inspiring students to do more research in regards to portion sizes are inconclusive. The results from this survey item were exceptionally close making it difficult to determine if college students would want to pursue further learning from MyPlate.gov after solely seeing the graphic.

Data collected during this study suggests that college students are able to correctly identify some portion sizes from the MyPlate graphic. Students correctly identified portion sizes for the dairy and protein food groups. Students over-estimated the vegetable group by 1/2 cup and the forty nine percent of participants over-estimated the grain group. The fruit group was underestimated by 1/2 cup. The over and under portion size estimation is overall inconclusive. However, it could be speculated from this data that the larger wedges on the graphic may influence students to over-estimate the portion size (i.e., vegetables and grains), while the smaller wedges (i.e., fruits) may lead to underestimation. The college population has been unable to correctly identify standard portion sizes according to various studies, but the results of this study show promise toward improvement in the ability of this population to correctly identify portion sizes.

Recommendations

Further research will undoubtedly take place to measure the effectiveness of the MyPlate graphic for the general public. This research found the graphic to be an effective tool for estimating portion size in a college population, and students were able to understand the overall

concept of the graphic. It may also be valuable for further research into the influence the size of the food group wedge has on over or under-estimation. Additional studies should continue to examine the usability of the MyPlate graphic for the general public. It will be especially vital for researchers to continue to evaluate the message of making half of one's plate fruits and vegetables and making these two food groups the largest components of a meal.

Other recommendations for future research with the MyPlate graphic that could provide beneficial results include having the participants take the survey while being proctored or timed. The use of an online survey that is untimed allows the participant to research the correct answers to the survey by visiting MyPlate.gov while taking the survey. This will ultimately skew the results in the favor of the effectiveness of the graphic. It may also be beneficial for future researchers to use actual food items or food models to represent the portion size options for the food items. Some participants may not have been familiar with how various cup or ounce sizes may look, and this could lead to over or underestimation or participants feeling the need to randomly guess answers. Having actual food items or food models could be a more accurate way to evaluate the effectiveness of the graphic because the food items or food models may be a more applicable situation to individual's actual meal time portions.

This study was not designed to determine what level or type of instruction was the most valuable in generating correct or incorrect responses in regards to estimating portion sizes of food groups. For future use of the MyPlate graphic it would be beneficial for health educators to have a body of research supporting the most effective teaching method to portray the use and concepts of the graphic. The complete remodel of the MyPyramid graphic into the MyPlate graphic has received both praise and controversy, but this research data suggests MyPlate is a useful tool for college students to estimate correct portion sizes.

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Appendix A: Memo of IRB Approval



November 2, 2011

Erin M. Niles
 Food and Nutritional Sciences Department
 UW-Stout

RE: Estimating Portion Sizes from Myplate

Dear Erin,

The IRB has determined your project, "*Estimating Portion Sizes from Myplate*" is **Exempt** from review by the Institutional Review Board for the Protection of Human Subjects. The project is exempt under **Category 2/3** of the Federal Exempt Guidelines and holds for 5 years. Your project is approved from **November 2, 2011**, through **November 1, 2016**. Should you need to make modifications to your protocol or informed consent forms that do not fall within the exemption categories, you will need to reapply to the IRB for review of your modified study.

If your project involved administration of a survey, please copy and paste the following message to the top of your survey form before dissemination:

This project has been reviewed by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46

If you are conducting an **online** survey/interview, please copy and paste the following message to the top of the form: **"This research has been reviewed by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46."**

Informed Consent: All UW-Stout faculty, staff, and students conducting human subjects research under an approved "exempt" category are still ethically bound to follow the basic ethical principles of the Belmont Report: 1) respect for persons; 2) beneficence; and 3) justice. These three principles are best reflected in the practice of obtaining informed consent from participants.

If you have questions, please contact Research Services at 715-232-1126, or foxwells@uwstout.edu, and your question will be directed to the appropriate person. I wish you well in completing your study.

Sincerely,

Susan Foxwell
 Research Administrator and Human Protections Administrator,
 UW-Stout Institutional Review Board for the Protection of Human Subjects in Research (IRB)

Appendix B: Consent Form

"This research has been reviewed by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46."

Description

This research is being conducted as one of the very first studies to determine the effectiveness of the MyPlate graphic. This short survey will provide information about whether or not college students are able to determine portion sizes from only looking at the graphic, and if they understand the main concepts behind the graphic itself.

Risks & Benefits

Since this is some of the first research being done on the effectiveness of this graphic, the results of this study will be very beneficial to everyone involved. It will benefit the USDA by providing feedback on if their graphic is portraying the correct message.

The only risk that accompanies participating in this short survey is giving up 5 minutes of time.

Time Commitment & Payment

There is about a 3 minute time commitment associated with completing this survey. This survey is a one time commitment, you will not be asked to do any follow-up surveys or questions.

Confidentiality

Once you click on the link to start the survey, the survey will become anonymous using Qualtrics Software. You will not be asked to provide your name or answer any personal identifying questions. By clicking on the link to the survey you agree to these conditions.

Right to Withdraw

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. Should you choose to participate, once you submit your response, the data cannot be linked to you and cannot be withdrawn.

Appendix C: Survey



Have you had any previous instruction on how to use the new MyPlate model?

- Yes
- No

Are you aware that the MyPlate model shown above has replaced the previous Food Pyramid?

- Yes
- No

To what extend was your instruction on how to use the MyPlate model?

- Self-taught
- Class lecture
- Other
- No previous instruction



Based on the above model, what would count as a reasonable serving for a meal from the dairy group?

- 1/3 cup milk
- 1 1/2 cups milk
- 2 cups milk
- 1/2 cup milk
- 1 cup milk

Based on the above model, what would count as exactly one serving from the grains group?

- 1 cup brown rice
- 1/4 cup brown rice
- 1/3 cup brown rice
- 1/2 cup brown rice
- 1 1/2 cups brown rice



Based on the above model, what would count as a reasonable serving for one meal from the protein group?

- 3 ounces of chicken
- 2 ounces of chicken
- 6 ounces of chicken
- 1 ounce of chicken
- 8 ounces of chicken

Based on the above model, what would count as a reasonable serving for one meal from the vegetable group?

- 1/3 cup raw cauliflower
- 1 cup raw cauliflower
- 1/2 cup raw cauliflower
- 1 1/2 cups raw cauliflower
- 2 cups raw cauliflower



Based on the above model, what would count as one serving from the fruits group?

- 1 1/2 cups sliced strawberries
- 2 cups sliced strawberries
- 1 cup sliced strawberries
- 1/2 cup sliced strawberries
- 1/3 cup sliced strawberries

Does the MyPlate model shown above make you want to further research what the model represents in regards to food groups and serving sizes?

- Yes
- No



What do you feel is a main concept of the MyPlate graphic?

- Make half your plate fruit and vegetables
- Make half your plate protein and grains
- Make half your plate fruit and grains
- make half your plate vegetables and protein

What do you feel is a main concept of the MyPlate graphic?

- Include 5 food groups in each meal
- Fruits and vegetables should be the largest components of the plate
- The size of the plate is the most important factor

Appendix C: Survey



Have you had any previous instruction on how to use the new MyPlate model?

- Yes
- No

Are you aware that the MyPlate model shown above has replaced the previous Food Pyramid?

- Yes
- No

To what extend was your instruction on how to use the MyPlate model?

- Self-taught
- Class lecture
- Other
- No previous instruction



Based on the above model, what would count as a reasonable serving for a meal from the dairy group?

- 1/3 cup milk
- 1 1/2 cups milk
- 2 cups milk
- 1/2 cup milk
- 1 cup milk

Based on the above model, what would count as exactly one serving from the grains group?

- 1 cup brown rice
- 1/4 cup brown rice
- 1/3 cup brown rice
- 1/2 cup brown rice
- 1 1/2 cups brown rice



Based on the above model, what would count as a reasonable serving for one meal from the protein group?

- 3 ounces of chicken
- 2 ounces of chicken
- 6 ounces of chicken
- 1 ounce of chicken
- 8 ounces of chicken

Based on the above model, what would count as a reasonable serving for one meal from the vegetable group?

- 1/3 cup raw cauliflower
- 1 cup raw cauliflower
- 1/2 cup raw cauliflower
- 1 1/2 cups raw cauliflower
- 2 cups raw cauliflower



Based on the above model, what would count as one serving from the fruits group?

- 1 1/2 cups sliced strawberries
- 2 cups sliced strawberries
- 1 cup sliced strawberries
- 1/2 cup sliced strawberries
- 1/3 cup sliced strawberries

Does the MyPlate model shown above make you want to further research what the model represents in regards to food groups and serving sizes?

- Yes
- No



What do you feel is a main concept of the MyPlate graphic?

- Make half your plate fruit and vegetables
- Make half your plate protein and grains
- Make half your plate fruit and grains
- make half your plate vegetables and protein

What do you feel is a main concept of the MyPlate graphic?

- Include 5 food groups in each meal
- Fruits and vegetables should be the largest components of the plate
- The size of the plate is the most important factor