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Translating MyPlate into Food Selections that Meet Dietary Guidelines Recommendations

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The objective was to determine if individuals could plan a diet that met the Dietary Guidelines (DG) using MyPlate as a guide. Participants (n=73) were 38.9±17.0 years of age, with 97% being Non-Hispanic White, 95% having some college education, and Body Mass Index (BMI) of 26.7±5.9. Participants used MyPlate to plan a one-day menu using food models. Nutrition literacy, nutrition scanning behavior, and nutrition information-seeking experience were assessed. Menus were analyzed using Nutrition Data Systems for Research and were compared to individualized DG recommendations. A multiple linear regression examined what characteristics predicted energy difference scores (difference between energy from menu and DG). Participant menus were lower in energy, grains, and dairy; and higher in fruits and vegetables than DGs ($p < 0.001$). The regression model was significant ($R^2 = 0.24$; $p < 0.01$) with sex ($B = -386.92$; $p < 0.05$), BMI ($B = 29.29$; $p < 0.05$) with nutrition information-seeking experience ($B = 44.90$; $p < 0.05$) predicting energy difference score. Being male, having a higher BMI, and experiencing more frustration during nutrition information-seeking were associated with higher energy difference scores. It was challenging for this sample of well-educated individuals to make food selections that met the DGs using MyPlate. Extension professionals should not assume that consumers understand and can apply the key messages of MyPlate.

Keywords: MyPlate, Dietary Guidelines, translating nutrition information

Introduction

Currently, many Americans are selecting diets that do not meet the national recommendations for optimal health and place them at higher risk for development of chronic disease (Hiza, Casavale,

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Guenther, & Davis, 2013; Krebs-Smith, Guenther, Subar, Kirkpatrick, & Dodd, 2010; Rice, Quann, & Miller, 2013; U.S. Department of Agriculture & U.S. Department of Health and Human Services [USDA & USDHHS], 2010). More specifically, Americans are consuming diets that are excessive in energy from solid fats and added sugars and insufficient in fruits, vegetables, and dairy (Krebs-Smith et al., 2010). In 2011, the U.S. Department of Agriculture (USDA) released MyPlate, an educational tool that was developed as a part of an initiative to help Americans make better food choices based on recommendations in the *2010 Dietary Guidelines for Americans* (Figure 1) (Post, Haven, & Maniscalco, 2011, 2012; U.S. Department of Agriculture: Center for Nutrition Policy and Promotion [USDA CNPP], 2011; USDA & USDHHS, 2010). The USDA materials recommend that the MyPlate icon is not meant to be used alone to change consumer behaviors but rather as a reminder to eat healthfully. Research has found that mothers who were familiar with MyPlate and found it to be relevant and easy to understand also thought the icon would help them and their children eat better (Wansink & Kranz, 2013). This suggests that individuals think MyPlate can be used to inform their eating habits and demonstrates the value in examining how the information presented by the MyPlate icon is translated to food selections.

Figure 1. The MyPlate Icon

An additional purpose of MyPlate is to direct consumers to the ChooseMyPlate.org website for supplementary information. However, previous research on MyPyramid, the nutrition icon predating MyPlate released with the *2005 Dietary Guidelines for* Americans (USDA & USDHHS, 2005), has shown that not all Americans have access to the Internet. Those with internet access may not visit the MyPyramid website to obtain nutrition information (USDA CNPP, 2005; USDA & USDHHS, 2005; Zoellner, Connell, Bounds, Crook, & Yadrick, 2009). Consequently, MyPlate, and previously MyPyramid, are often viewed and interpreted independent of additional information. For MyPlate to fulfill its intention of prompting consumers to think about positive dietary behaviors, it is of interest to determine if individuals are able to process its contents and translate the information into food selections that meet the *Dietary Guidelines* recommendations. To date, there is no research assessing the use of the MyPlate icon independently to guide food selections.

Research also suggests there may be individual differences in the ability to interpret health information (Cutilli & Bennett, 2009). Health literacy, or the capability to obtain, process, and

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understand health information, is associated with more positive health behaviors (Selden, Zorn, Ratzan, & Parker, 2000). Previous research found health literacy was higher in women than men; in White and Asian/Pacific Islanders compared to Black, American Indian/Alaskan Native, Hispanic, and multiracial adults; and in adults aged 25–39 compared to other adult age groups (lower health literacy rates are found in adults 65 years and older) (Cutilli & Bennett, 2009).

Nutrition literacy is similar to health literacy but relates specifically to nutrition (Zoellner et al., 2009). Research on nutrition literacy has found that greater nutrition literacy is associated with a healthier eating pattern (Wall, Gearry, Pearson, Parnell, & Skidmore, 2014). The relationship between nutrition literacy and understanding MyPlate has not been examined. An individual's health seeking behaviors and overall experience searching for health information may be related to health knowledge and application of health information (Arora et al., 2007; Shim, Kelly, & Hornick, 2006). Health information-seeking behaviors are positively related to health habits, with individuals who actively search for health information having a greater health knowledge and adoption of healthier behaviors (Shim et al., 2007). Since nutrition is one aspect of health, a similar relationship may exist between an individual's approach and experience searching for nutrition information and his/her nutrition-related habits; however, this has not been examined.

The primary purpose of this study was to compare a one-day menu developed using MyPlate to individualized (based on age, sex, weight, and physical activity level) dietary recommendations from the *2010 Dietary Guidelines for Americans* (USDA & USDHHS, 2010) to see if MyPlate can be used independently as a tool for planning a menu in line with recommendations. A secondary purpose was to examine what individual characteristics (demographic characteristics, nutrition literacy, attention to nutrition information, and nutrition information-seeking experience) were related to selecting a menu that was most consistent with the recommendations.

Methods

A convenience sample of participants was recruited at a small, private university from March to September 2012 through flyers placed around campus; faculty, staff, and student e-mail listservs; and direct mailings to campus mailboxes of faculty and staff. Inclusion criteria were that the participant needed to be English speaking and between the ages of 18 and 65 years. Participants were excluded if they had a degree or minor in nutrition or were a current student pursuing a degree or minor in nutrition as these individuals were assumed to have a greater knowledge about nutrition and the MyPlate icon at the start of this study than the general population. The University's Institutional Review Board approved this study.

Participants came to the Human Performance Laboratory at Marywood University for two individual appointments scheduled two weeks apart. At the first session, after informed consent was signed, participants completed a demographics questionnaire that assessed age, sex,

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education level, race, ethnicity, and physical activity; the New Vital Sign (NVS) nutrition literacy questionnaire; and the Attention to Nutrition Information and Information-Seeking Experience (ANIISE) questionnaires (Arora et al., 2007; Shim et al., 2006; Weiss et al., 2005).

The NVS is a validated health and nutrition literacy screening tool (Weiss et al., 2005). Participants were verbally provided with six interview-administered questions related to a nutrition facts food label. The instrument was developed as a screening method to measure health literacy, or a person's ability to understand and process health information. A total score is calculated by counting the number of correct answers, resulting in a possible score of 0 to 6, with higher scores representing greater nutrition literacy. The instrument shows good reliability ($\alpha > .70$) and performs well against other validated literacy instruments (Weiss et al., 2005).

The ANIISE questionnaires were originally developed to assess attention to and the seeking experience for finding health information (Arora et al., 2007; Shim et al., 2006). The instruments were tested for reliability and indicated adequate internal consistency ($\alpha = .70$ and .82, respectively). For this study, the word "health" was changed to "nutrition," and "nutrition" was added before the word "information" in the ANIISE to focus on nutrition information specifically. Five people from the target population participated in a respondent debriefing process. They were informed on the purpose of the study and questionnaire. Then, the researcher asked each question and provided probes to the participant to assess clarity and understanding of questions. All participants felt the questions were clear and no further changes were made. A summary variable was calculated for each of the two subscales of the questionnaire. An attention to nutrition information summary variable was calculated by averaging the participant responses to the five items in that subscale (higher score indicates more attention is paid to nutrition information from a variety of sources) (Shim et al., 2006). A nutrition information-seeking experience subscale was calculated by creating a composite score for the six items in that subscale (higher score indicates a higher level of frustration with the process of finding accurate nutrition information) (Arora et al., 2007).

Height was measured on a stadiometer after removing shoes, and weight was measured on a calibrated scale (Weigh Beam Eye-Level Model #337, Detecto, Webb City, MO, USA) with shoes and outer layers of clothing removed according to standard protocols (Lohman, Roche, & Martorell, 1988). Body Mass Index (BMI) was then calculated as weight in kilograms (kg) divided by height in meters squared (m^2).

In a separate room, a large variety of food models (Nasco, Fort Atkinson, WI, USA; with representation from all of the food groups) and papers labeled Breakfast, Lunch, Dinner, and Snacks were available, and either the MyPlate or MyPyramid icon was on display (only results from MyPlate are included in the current study). The MyPlate poster was printed from the ChooseMyPlate.gov website (Figure 1). Participants were randomly assigned to view either

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MyPlate or MyPyramid at their first session via the coin flip method. Participants were asked to use the icon and provided food models to plan a full day's menu for someone of their same age, gender, height, weight, and physical activity level they believed would match the information displayed on the poster. Participants were told to select foods for breakfast, lunch, and dinner and to include snacks if they thought snacks would be necessary to help them meet the guidelines recommended on the poster. To select foods for an individual meal or snack, the participants were told to place the selected food models in the designated spot on the table for the specific meal or snack that was marked with a paper labeled with the name of the eating occasion. Each paper also included blank lines where participants had the opportunity to write in any foods that they wished to include on their one-day menus that were not available as food models.

Once the participants made their menu, the research assistant reviewed, in detail, the foods that were selected for each meal and snack and asked the participant for any necessary clarifications. For each food selected, research assistants inquired about the serving size of the food ("How much would you plan to eat of this food?"), how the food would be prepared ("Would you plan to have the chicken baked or fried?" or "Would oil be added for cooking?"), and if there would be any additions to the food. Example clarification questions about additions to foods included asking about common food combinations such as if a participant would plan to add creamer to coffee, milk to cereal, or dressing to a salad. At the second session (2 weeks later), the same protocol was followed except the other icon was displayed. After completing both sessions, participants were compensated for their time with a $10 gift card to a local supermarket.

The participant menus were entered into Nutrition Data Systems for Research (NDS-R, version 2013) developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, to calculate total energy and servings from each food group: grains, vegetables, fruits, dairy, and protein. This calculated dietary information was then compared to the energy and food group recommendations provided by the *2010 Dietary Guidelines for Americans* for an individual of the participant's same age, gender, height, weight, and activity level. For example, the information for a 20-year-old female that weighed 140 lbs., was 5'7" tall, and was physically active less than 30 minutes per day was entered into the SuperTracker on ChooseMyPlate.gov which provided the following daily recommendations: 2,000 Calories, 6 oz. grains, 2.5 cups vegetables, 2 cups fruit, 3 cups dairy, and 5.5 oz of protein. An "energy difference score" was calculated by subtracting the Dietary Guideline energy recommendation from the amount of energy in the menu the participant developed. A larger energy difference score represents a menu that is further from the recommendations.

Data Analysis

To compare the differences between total energy and servings from each of the food groups for the menus selected using MyPlate and the *2010 Dietary Guidelines* recommendations, *t*-tests

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were calculated. A multiple linear regression was used to determine if demographic characteristics (age, sex, BMI, and education), nutrition literacy, attention to nutrition information, and nutrition information-seeking experience predicted energy difference score. Results were considered significant at $p < 0.05$. Data were analyzed using IBM SPSS (version 21, 2013, SPSS Inc., Chicago, IL).

Results

Participants ($N = 73$) were predominantly female (83.6%), had at least some college education (95.9%), were White (97.3%), and non-Hispanic (100%). Table 1 provides further details of the participant demographics. Only one participant was lost to follow-up.

Table 1. Participant Characteristics and Scores on the NVS and ANIISE Questionnaires

Characteristic	
Age (years)	38.9 ± 17.0
Sex (% female)	83.6
Race (%)	
Black	2.7
White	97.3
Hispanic (%)	
Yes	100.0
No	0.0
Education (%)	
High School	4.1
Some College	26.0
College Graduate	26.0
Graduate School	43.8
Weight Status (%)[a]	
Underweight	4.1
Normal Weight	43.8
Overweight	21.9
Obese	30.1
Test Scores	***M (SD)***
NVS	5.2 (1.2)
ANIISE - Attention to Nutrition Information	2.5 (0.6)
ANIISE - Nutrition Information-Seeking Experience	14.2 (2.9)

[a]Weight status based on Body Mass Index (BMI). BMI < 18.5 – Underweight, BMI 18.5-24.9 – Normal Weight, BMI 25-29.9 – Overweight, BMI 30 and above – Obese (Centers for Disease Control and Prevention, 2015)

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Results showed that the participant-planned menus using MyPlate were significantly ($p < 0.001$) different from the *2010 Dietary Guidelines* recommendations in energy, grains, vegetables, fruits, and dairy. More specifically, the menus were significantly lower in energy, grains, and dairy and higher in fruits and vegetables than the recommendations (see Table 2).

Table 2. Energy and Food Group Comparisons Between Menus Selected Using MyPlate and the 2010 Dietary Guidelines Recommendations (M ± SD)

Variable	MyPlate Menu	Recommendation	*p*-value
Energy (kcals)	1426 ± 475	2169 ± 369	< 0.001
Grains (ounces)	3.7 ± 2.1	7.0 ± 1.5	< 0.001
Vegetables (cups)	3.8 ± 1.7	2.8 ± 0.5	< 0.001
Fruit (cups)	3.4 ± 1.7	1.9 ± 0.3	< 0.001
Dairy (cups)	2.2 ± 0.8	3.0 ± 0.1	< 0.001
Protein foods (ounces)	5.6 ± 2.5	5.9 ± 0.6	0.365

Note: Values are considered significantly different at $p < 0.05$

The linear regression model was significant ($R^2 = 0.24$; $p < 0.01$) with sex ($B = -386.92$; $p < 0.05$), BMI ($B = 29.29$; $p < 0.05$), and nutrition information-seeking experience ($B = 44.90$; $p < 0.05$) significantly predicting energy difference score. Being male, having a higher BMI, and experiencing more frustration during nutrition information-seeking was associated with a higher energy difference score.

Discussion

The primary purpose of this study was to determine if adults could use the MyPlate icon to plan a full day's menu that met the recommendations from the *2010 Dietary Guidelines for Americans.* We found that when using MyPlate as a guide, participants selected diets that were vastly different than recommendations. Specifically, the menus were lower in energy, grains, and dairy and higher in fruits and vegetables than the recommendations. MyPlate is a tool used to help disseminate messages that represent the *Dietary Guidelines*, and while it is not intended to change behaviors by itself, if an individual uses MyPlate to direct food choices, he/she should theoretically select foods that results in a diet that is in line with the *Guidelines*. This is the first study to assess the use of MyPlate to make food selections. A secondary purpose was to determine if individual differences predicted ability to plan a menu in line with recommendations. We found that males, individuals with a higher BMI, and those that experienced more frustration when searching for nutrition information planned menus that were furthest from concordance with the *Dietary Guidelines* recommendations.

In the present study, participants planned a menu that was significantly lower in energy than the *Dietary Guidelines* recommendations. Although Americans that are overweight or obese may

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benefit from an energy deficit that could lead to weight loss, that was not necessarily the case with the sample population as almost half were normal weight or underweight (as defined by their BMI) (Centers for Disease Control and Prevention, 2015; Hill, 2006). Additionally, since aiding in weight loss is not the intent of MyPlate, the energy deficit was not an appropriate interpretation of the information on the icon. One reason for the low energy level of the menu was that participants selected an excess number of servings from food groups that have lower energy options (fruits and vegetables) and fewer servings from the food groups that tend to have higher energy foods (grains and dairy). Beyond aiding with consuming an appropriate amount of energy per day, there are additional health benefits associated with meeting the recommendations for each of the individual food groups. While an excess in the number of servings from fruits and vegetables in the menus may not be harmful and, in fact, may further reduce risk for chronic disease, the issue may be that selecting a large number of servings of fruits and vegetables may reduce the inclusion of foods from other food groups (specifically, dairy and grains in this study) that are equally important (Boeing et al., 2012; Hung et al., 2004).

Our findings that females selected menus that were more representative of the *Dietary Guidelines* than males are consistent with previous research. Women have been found to have higher health literacy (Cutilli & Bennett, 2009), greater nutrition knowledge (Hendrie, Coveney, & Cox, 2008; Parmenter, Waller, & Wardle, 2000), and overall healthier diets (Hiza et al., 2013; Imamura et al., 2015) than men. It is therefore not surprising that the women in the study were more successful in using MyPlate to plan a menu that aligned more closely with the *Guidelines*.

Research on dietary intake assessment potentially provides insight on why we found that individuals with a higher BMI planned menus further from the recommendations. It has consistently been shown that overweight and obese adults underestimate dietary intake more so than normal weight individuals (Bailey, Mitchell, Miller, & Smiciklas-Wright, 2007; Headrick, Rowe, Kendall, Zitt, Bolton, & Langkamp-Henken, 2013). If the perception of what an overweight or obese individual usually eats is underestimated, that may have resulted in planning a menu that underestimated the volume of food that would be recommended to consume. Thus, it is not surprising that increasing BMI was associated with a larger gap between energy planned in the menu and energy recommended by the *Dietary Guidelines*.

Results indicated that individuals who reported being more frustrated with their experience looking for nutrition information were less successful in using MyPlate to plan a menu. Research linking nutrition-related information-seeking to nutrition knowledge or dietary choice is limited. However, studies have shown a positive correlation to nutrition information-seeking behavior, food label reading, and motivation (Elbon, Johnson, & Fischer, 1996; Szwajcer, Hiddink, Koelen, & van Woerkum, 2005). One study found that students with higher self-efficacy in reading nutrition information made better dietary choices (Worsley, Worsley, Coonan, & Peters, 1985). Therefore, it is not surprising in the present study that frustration with

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nutrition information-seeking behavior was negatively associated with ability to accurately plan a menu using the MyPlate icon. Future studies attempting to identify the root of frustration during nutrition information seeking behavior may provide vital insight into the reason frustration is negatively associated with the ability to translate nutrition information accurately.

It is important to note that these participants were well-educated and scored high on the nutrition literacy questionnaire (84.9% of participants' scored 4 or better on the NVS, indicating adequate literacy). These characteristics may provide them with an advantage in interpreting this information over the general population as a whole, yet they still did not select food choices in line with recommendations. Thus, it is clear that for this group, additional information was needed for the icon to be effectively used for implementing positive dietary choices.

This study is the first to examine the use of MyPlate to plan a daily menu; thus, the use of a homogenous sample was appropriate for an initial study. However, a large limitation of this study was that participants were over 97% White and well-educated, which does not allow for the results of this study to be generalized to the American population as a whole. Another limitation of this study is that food models were used to simulate food selections; thus, we do not know how MyPlate would be used to guide actual food consumption.

A recently published manuscript outlining a recommended framework for research evaluating the effectiveness of the MyPlate message dissemination describes two main areas of interest, one of which is a focus on how well the *Dietary Guidelines* are being communicated to vulnerable populations (Levine, Abbatangelo-Gray, Mobley, McLaughlin, & Herzog, 2012). Future research in this area with individuals with a lower education or income level and minority populations would help describe how well a more diverse population interprets MyPlate for menu planning. Other ideas for future research include using a controlled environment where participants are provided with real food and asked to plan meals after viewing the icon or adding an additional assessment of participant intake by collecting a 24-hour recall prior to and after introduction to MyPlate to determine if exposure to the icon results in changes in dietary behaviors. Finally, examining the effects of making additions to the MyPlate icon, such as including quantitative recommendations (such as 2-3 servings of fruit per day) and a description of what counts as a serving, would be of interest to see if this additional guidance makes a stronger impact on selecting foods more in line with recommendations.

MyPlate often serves as the gateway for providing information about the *Dietary Guidelines* for the general public. Ideally, when an individual sees the icon, he/she will use the reference to the ChooseMyPlate.gov website as an impetus to investigate specific personal recommendations. Since we know that many people do not access this online information, the authors believe that it is important that these icons provide adequate information to help individuals select a healthy diet independent of accessing the website. The method for providing additional information that

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aids with dietary planning and how to tailor this information to suit different populations remains to be determined by future research. Adding pictures of the types of foods that fall into each food group and focusing on those foods that are specifically recommended (e.g., including pictures of whole fruits rather than fruit juice and of whole grains rather than refined grains) as well as adding the range of the number of servings that most individuals should consume from each food group (e.g., 2 cups of fruit per day) may be additions that would allow MyPlate to become more helpful for encouraging daily food selections that meet the *Dietary Guidelines*. Since at this time, such additional information is not available on the icon, Extension professionals working with clients at a variety of educational levels should be aware that individuals may not understand the key messages for healthy eating that are supposed to be represented by MyPlate. For consumers that do not have access to the Internet or those that have access but may not choose to go to the ChooseMyPlate.gov website, additional materials and verbal instructions should be provided to help with translating the MyPlate icon into healthy dietary choices.

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