Association of Food label Use with Selected Portion Sizes by College Students

at University of Wisconsin-Stout

by

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ABSTRACT

The prevalence of obesity has increased in the United States which may be due to increasing food portion sizes. The use of the food label is recommended to make people aware of the portion distortions. The purpose of this study was to examine the association of the food label use with selected portion sizes by college students. One hundred twelve participants were asked about their typical portion size using life-sized food photographs. Also, they were asked about the frequency of label use and the understanding of the serving size as well as the calorie information on the label using the food label. It was found that approximately 40% or more students selected larger portion sizes compared to the reference sizes. The majority of students frequently read the label as well as used the label when consuming food. Over 45% of students correctly identified the serving size whereas over 65%-of students

estimated the correct amount of calories. Although students read the food labels frequently as well as understood the label information, they did not effectively interpret the information for selection of portion sizes. However, frequency of use of serving size information with health consciousness helped students to select smaller snack portions.

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Chapter I: Introduction

According to the National Institute of Diabetes and Digestive and Kidney Disease (NIDDK), from 1960 to 2004 the prevalence of obesity has increased among adults in the United States from 13.3 to 32.1%, with most of this increase occurring in the last two decades (2007). Obesity is a leading cause of heart disease and a known risk factor of several chronic diseases in the United States (NIDDK, 2007; United States Department of Health and Human Services, 2007). In addition to contributing to increased chronic diseases, obesity also translates into increased health costs (Finkelstein, Fiebelkorn, & Wang, 2003). Finkelstein, Fiebelkorn and Wang estimated that obesity related medical expenditures were $92.6 billion in 2002.

The rapid increase in the prevalence of obesity has led to the suggestion that the current eating environment of access to large portions of food leads to increased energy intake (Rolls, 2003). According to the Center for Disease Control (CDC, 2006), the portion sizes of meals offered in restaurants increased 75% between 1977 and 1991. Similarly, the portion sizes of packaged snacks, beverages and ready-to-eat foods have been growing from the 1970s and most exceed the United States Department of Agriculture (USDA) serving size standards (Young & Nestle, 2002). Consuming larger portion sizes of foods, especially calorie-dense foods, automatically leads to increased energy intake.

Several studies indicate that people consume more food when presented with larger portion sizes (Rolls, Morris, & Roe, 2002; Rolls, Roe, Kral, Meengs, & Wall, 2004). Rolls, Morris, and Roe (2002) examined how people respond to four different portion sizes of macaroni and cheese offered on different days. The participants consumed 30% more energy when they were served the largest portion compared with when offered the smallest portion.

In addition, this research found that no significant differences in the ratings of hunger and satiety were found after each meal despite the intake difference. Rolls, Roe, Kral, Meengs, and Wall (2004) examined how different portion sizes of a snack affect energy intake of each snack and of the subsequent meal. Five different packages of potato chips were given to the participants as an afternoon snack. Their snack intake increased significantly when the package size increased. When the participants received dinner three hours after the snack consumption, they didn't adjust their intake of food at dinner to compensate for the extra calories obtained from the larger snacks. These results indicate that people perceive large proportion sizes as appropriate and are unable to adjust caloric intake at the next meal.

According to Wansink and Chandon's research (2006), people have a tendency to underestimate calories when they encounter large meals. This underestimation may contribute to the selection of large portion sizes of food as well as increasing obesity prevalence even when people consciously watch their diet.

The misperception of portion sizes may influence the self-selected food people eat daily and can lead to increased obesity prevalence in the U.S. It is important to know how much food we generally consume every day; however, little research has been done on misperception of portion sizes (Schwartz, & Byrd-Bredbenner, 2006). Burger, Kern, and Coleman (2007) investigated how much college students consume when allowed to freely select the portions themselves. They found that self-selected portion sizes were substantially larger in 10 out of the 15 food or beverage items as compared with the reference portion amount customarily consumed per eating occasion established by the United States Food and Drug Administration (FDA) (Seligson, 2003).They also reported that there was a strong relationship between Body Mass Index (BMI) and the large portion sizes selected. Schwartz

and Byrd-Bredbenner (2006) investigated typical portion sizes selecte by college students different food items and compared them with reference portion sizes and the results previously collected in the college students through research by Guthrie (1984). They found selected typical portion sizes of college students were larger than the reference portion sizes as well as the portion sizes reported two decades ago (Schwartz & Byrd-Bredbenner, 2006).

In order to avoid the misperception of portion sizes, the CDC recommends the use of the Nutrition Facts Label, in which the serving size and certain nutrients are listed. The Nutrition Facts Label can help people estimate the proper portion size (CDC, 2006; Meadows, 2005). Similarly, the Dietary Guidelines for Americans by the USDA also recommended the use of the Nutrition Facts label to control portion size (USDA, 2000).

Several studies have shown that the use of the Nutrition Facts Label is positively associated with food selecting attitudes and behaviors (Perez-Escamilla & Haldeman, 2002; Neuhouser, Kristal, & Patterson, 1999). It is important to investigate college students' use and their understanding of the Nutrition Facts label as well as whether these factors affect their selected portion size in order to develop appropriate nutrition education materials; however, no research has yet been done.

Statement of the Problem

The primary purpose of this study was to investigate the difference between the reference portion sizes and selected portion sizes by students at the University of Wisconsin-Stout. Additional purposes were to examine the frequency of reading serving size and calorie information on the Nutrition Facts label, the frequency of use of the serving size and calorie information on the Nutrition Facts label when eating a food item, and the students' understanding of the serving size, as well as the ability to estimate the calorie

content per food item using the Nutrition Facts label affect on portion sizes selected. An additional purpose was to investigate whether BMI is related to portion sizes selected. The last purpose was to examine the difference in portion sizes selected by students between genders. This study was done through a survey and attached photographs of various portions of food items and was conducted from March 1 to April 3, 2008. Funding for this study was obtained through the University of Wisconsin-Stout. The UW-Stout grant covered the study expenses of printing for food photographs as well as survey forms.

Research Questions

There are 15 research questions this study will attempt to answer. These questions are:

1. Are portion sizes selected by students different from the reference portion sizes?
2. Does gender difference affect the portion sizes selected?
3. Does students' BMI affect the portion sizes selected by students?
4. Is there a difference in the self-selected portion sizes between the hungry or not hungry state?
5. Is there a difference in the self-selected portion sizes between the liking and dislike for food items?
6. How frequently do students read the serving size and amount of calorie information to fit food into their diet?
7. How frequently do students use the serving size and amount of calorie information on the Nutrition Facts label to fit food into their diet when consuming food?

8. Can students correctly identify the serving size of food using the Nutrition Facts label?
9. Can students correctly estimate calorie content of food using the Nutrition Facts label?
10. Does the frequency of reading the serving size information in the Nutrition Facts label affect the self-selected portion sizes?
11. Does the frequency of reading the calorie information in the Nutrition Facts label affect the self-selected portion sizes?
12. Does the frequency of use of the serving size information in the Nutrition Facts label to fit food their daily diet when consuming food affect the self-selected portion sizes?
13. Does the frequency of use of calorie information on the Nutrition Facts label to fit food their daily diet when consuming food affect the self-selected portion sizes?
14. Does the understanding of serving size information affect the self-selected portion sizes?
15. Does the understanding of calorie information affect the self-selected portion sizes?

Definition of Terms

The following terms are defined for the purpose of this study.

Body Mass Index: A means for the indication of weight status in adults, it is a measure of weight for height (CDC, 2007a).

Portion Size: "The amount of a single food item served in a single eating occasion" (CDC, 2006).

Reference Portion Size (Reference Amounts Customarily Consumed (RACCs)): An amount that is customarily consumed. The US FDA established Reference Amounts Customarily Consumed for 139 food product categories and criteria for determining label serving sizes from the RACCs (Seligson, 2003).

Serving Size: "A standardized unit of measuring foods used in dietary guidance for Americans" (CDC, 2006 p 2). The serving sizes that appear on the Nutrition Facts label are based on the FDA established lists of "Reference Amounts Customarily Consumed (RACCs)" (Seligson, 2003 p 248).

USDA Serving Size Standard: Serving sizes for the Food Guide Pyramid food groups (Seligson, 2003).

Assumptions of the Study

This study was conducted under the following general assumptions:

1. All participants generally eat the food items contained in this survey.
2. All participants can estimate their portion sizes of food by seeing photographs of different portions.
3. The portion sizes of food items examined represent the portion sizes that students generally consume.

Limitations

Known limitations to the study include:

1. Some participants may not be able to accurately remember the portion sizes due to the indifference to foods or unfamiliarity.

2. Some subjects may not correctly estimate calorie content of a food item using calorie information in the Nutrition Facts label due to the lack of math skill.
3. The instruments such as survey questions and photographs attached with the survey in this study were developed by the researcher; no measurement of validity or reliability has yet been done.
4. The number of food items examined in this study was limited due to the limited period of time to allow students to complete the survey.
5. The number of different portion sizes examined in this study was limited because of the difficulty to express the portion size differences as a photograph.

Organization

The format of this paper includes the following: introduction, literature review, methodology, results, discussion, references and appendices.

Chapter II: Literature Review

Introduction

This chapter will discuss the trend in portion sizes and effect of portion size on food and energy intake among children and adults, current self-selected portion size studies, recommendations for portion control, and the food label use among people. Also, food photographs as a tool for estimation of portion sizes will be explained. The chapter will end in a conclusion of the literature review.

Trends in Portion Sizes

Studies have been done to examine the trends in portion sizes. Young and Nestle (2002) compared the current and past weights of ready-to-eat food through data from manufacturers, and concluded that portion sizes of these foods have been increasing since the 1970s and exceed federal standards. Another study by Nielsen and Popkin (2003) compared two data sites; one from the Nationwide Food Consumption Survey in 1977-1978 and the other from the Continuing Survey of Food Intake by Individuals (CSFII) in 1989-1991, and 1994-1996. They investigated patterns and trends of portion sizes of "Key Foods" that are thought to contribute to the energy intake in the U.S. such as salty snacks, desserts, French fries, hamburgers, Mexican foods, pizza, and soft drinks. They reported that food portion sizes increased for all categories except pizza. Additionally, energy intake of salty snacks, soft drinks, hamburgers, French fries, and Mexican food increased as well.

Effects of Portion Size on Food and Energy Intake among Children and Adults

There are several studies to examine the effect of portion sizes on energy intake among children (Rolls, Engell & Birch, 2000; Fisher, Rolls & Birch, 2003). Rolls, Engell and Birch (2000) reported that there was a difference in effect of portion sizes between three

and five-year-olds. Three-year-old children consumed similar amounts when portion size of macaroni and cheese increased whereas five-year-old children consumed significantly more energy when the size increased. Another study by Fisher, Rolls, and Birch (2003) also reported that pre-school-aged children consumed 25% more energy intake when the portion size was doubled. Ello-Martin, Ledikwe, and Rolls (2005) explained that very younger children can self-regulate their intake by responding to hunger and fullness when large portions of foods are given whereas older children's food intake are influenced by external factors more than internal cues such as hunger.

Similar to children, adults consume more food when presented with larger portion sizes (CDC, 2006). They have tested the effect of portions in several eating occasions, such as single meal, entrées in a restaurant, combination of snack and subsequent meal, and foods over several days.

As a single meal experiment, Rolls, Morris, and Roe (2002) provided four different portion sizes of macaroni and cheese to the participants on different days and found that participants consumed 30% more energy (162 Kcal) when the largest portion (1000 g) was given compared with when the smallest portion (500 g) was given. Rolls, Roe, Meengs, and Wall (2004) conducted a similar study using four different sizes of sandwiches instead of macaroni and cheese. They also found that the participants significantly increased their energy intake when the size of the sandwich increased. In these studies, the participants reported no significant difference in ratings of hunger and fullness at the end of the meals.

One study investigated the effect of portions in a cafeteria-style restaurant (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004). They examined whether increasing the portion size of a pasta entrée from 248 g (standard portion) to 377 g affected the intake when the price

didn't change. They found that customers who chose the largest portion increased their energy intake of the entrée by 43% compared with those who chose a standard portion. They also reported that no difference between the two groups of customers in ratings of the amount that was eaten as compared with their usual meal.

One study by Rolls, Roe, Kral, Meengs, and Wall (2004) investigated how the portion size of a snack affects the energy intake of both the snack and the subsequent meal. Participants received five different packages (28, 42, 85, 128, or 170 g) of potato chips on five different occasions as an afternoon snack. Then, they received dinner after three hours after the snack consumption. The participants significantly increased their intake of potato chips when the package sizes increased. When the participants increased their snack intake with the larger portion sizes, they didn't reduce the intake of food at the subsequent dinner in order to compensate for the increased energy intake and fullness.

Rolls, Roe, and Meengs (2006) examined the effect on energy intake of increasing the portion size of all foods and beverages, 100, 150, or 200 percent of baseline amounts, served over two consecutive days. They reported that increasing all portions by 50% increased daily energy intake by 16% and increasing portions by 100% increased daily energy intake by 26%. Also, the participants didn't adjust their subsequent food consumption over the period even though the portions were increased. These results suggest that the availability of larger portions is associated with excess energy intake that could contribute to increased body weight.

Current Self-selected Portion Size Studies

Little research has been conducted to investigate how portion distortions affect portion sizes selected when individuals serve themselves (Schwartz & Byrd-Bredbenner,

2006). Burger, Kern, and Coleman (2007) investigated the typical portions of daily food and beverage items (15 items) among college students and the relationship between selected portion size and BMIs, gender, and characteristics of the food, such as macronutrient content, food-energy density, and form. The food items included peanuts, rice as a main dish, rice as a side dish, M&M candies, two different portion sizes of tortilla chips (small bag vs. big bag), Cheerios, peanut butter, pudding, margarine, applesauce, macaroni and cheese, strawberry jam, water, and Coca-cola. The participants were recruited to participate via advertisements. A total of 51 participants served themselves a serving of each food item that they generally consumed; and then the weight of food was measured each time and recorded by the researcher. This result was compared with the reference amount, the standard portion size established by the FDA. The participants were also asked about their familiarity with and liking for each food item as well as their degree of hunger. As a result, participants selected substantially larger portion sizes for 10 of the 15 food items compared to the reference portions sizes. These ten foods included peanuts, rice as a main dish, M&M candies, medium-size bag of tortilla chips, large-size bag of tortilla chips, Cheerios, macaroni and cheese, strawberry jam, water, and Coca-cola. Also, accounting for both the hunger and liking, the participant's BMI positively predicted the increasing absolute differences in the self-selected portion sizes from the reference size for five of the 15 food items, that included peanuts, M&M candies, Cheerios, jam, and soda (Burger, Kern, & Coleman, 2007).

Another study by Schwartz and Byrd-Bredbenner (2006) investigated typical portion sizes selected by college students using different food items (8 items for breakfast and 6 items for lunch or dinner) and compared them with reference portion sizes as well as the

data collected for college students in 1984. The food items used in the study were the same as the items used in Guthrie's study (1984) for comparison. Schwartz and Byrd-Bredbenner confirmed that the food items were on the USDA's current key food list in which foods that people commonly eat in the U.S are listed. The food items included cornflakes, milk on cereal, sugar on cereal, toast, butter, jelly, milk to drink, and orange juice for breakfast, tuna salad, bread, tossed salad, salad dressing, fruit salad, and soda for lunch as well as dinner. The participants who were enrolled in an introductory level psychology course were invited to participate in the study in return for one free meal. A total of 63, 62, and 52 individuals participated in the breakfast, lunch and dinner, respectively. Before selecting foods by themselves at a buffet table, they were asked about their age, gender, college major, hunger status, and liking for the food items. The food portions were measured and recorded after selection. This result indicated that the self-selected portion sizes of cornflakes, milk on cereal, and jelly tended to exceed to the reference sizes by more than 25%. Also, the self selected portion sizes for cornflakes, milk on cereal, orange juice and fruit salad were significantly larger in 2003 as compared with the previous study in 1984. Finally, the self-selected portion sizes were not significantly influenced by liking and hunger status (Schwartz, & Byrd-Bredbenner, 2006). Another study (Colapinto, Fitzgerald, Taper, & Veugelers, 2007) investigated the usual portion sizes of French fries, meats, vegetables, and potato chips using three-dimensional graduated food model among fifth-grade students. Students were given three different sizes of each food model and asked to select their usual portion sizes. They found that the students preferred larger portion sizes of French fries, meats, and potato chips and smaller portions of vegetable than that recommended for children by the USDA as well as the Canada's Food Guide to Healthy Eating.

Strategies for Avoiding Portion Distortions

It is important to make people aware of eating habits in response to oversized portions. The CDC (2006) announced several recommendations for increasing awareness of portion distortion as well as for portion controls.

One of the recommendations was to use the Nutrition Facts label since its use can help people understand that portion sizes are often larger than they expect. The CDC referred readers to the FDA website, where people can learn how to use the Nutrition Facts label on the food packages.

Another recommendation is to serve reasonable portions on individual plates and avoid the temptation of second and third helpings when eating at home. Additionally, the CDC recommends people to put a reasonable amount of food into a serving container, and not to eat from the package, especially larger sized packages, when eating or snacking in front of the TV. In the case of eating out, it is recommended to split the food with other people or putting half of the meal in a doggie bag when large portions are encountered at restaurants.

As with the CDC, the Dietary Guidelines for Americans stated similar recommendations for dealing with larger portions, such as carefully reading the food label, limiting portion sizes of foods high in calories, and sharing foods with others when facing larger portions at restaurant (USDA, 2000).

Label Use

Several studies investigated how people use the Nutrition Facts label. Marieta, Welshimer, and Anderson (1999) examined the knowledge, attitudes, and behaviors of college students regarding labels. They developed their own survey, the Label Reading

Survey, from a review of materials used in label-reading education. They reported that 70% of students looked at the Nutrition Facts label when purchasing products for the first time. Additionally, 43% of students used the label to fit the food into their daily diet when consuming food. They also reported that students' mean knowledge score about the Nutrition Facts label was 48%. Neuhouser, Kristal, and Patterson (1999) also investigated frequency of use of the Nutrition Facts label among adults; and they found that 80% of people reported usually, often or sometimes reading the nutrition label. They also found that 44.8% of people usually read the serving size information as well as 68.6% of people usually read the calorie information. Rothman et al. (2006) examined patient's ability to read and understand nutrition information from food labels. Their survey, the Nutrition Label Survey (NLS), consisting of 24 questions was designed with input from registered dietitians, primary care providers, and experts in health literacy, to evaluate patient understanding of current nutrition labels. In this study, 89% of patients reported using the nutrition label. Patients could answer 69% of the food label questions correctly on average. The authors explained that common reasons for incorrect responses included misapplication of the serving size, confusion due to extraneous material on the food label, and incorrect calculations.

There are several studies to show that the use of Nutrition Facts Label is positively associated with food selection attitudes and diet quality. Neuhouser, Kristal, and Patterson (1999) conducted a population-based, cross-sectional telephone survey of adults to investigate the association of nutrition label use with fat-related diet habits, fruit and vegetable consumption, health behavior, and demographic characteristics. They found that label use was significantly associated with low-fat intake. Additionally, the strongest

predictors of label use were believing in the importance of eating a low-fat diet, believing in the association between diet and cancer, and being in the maintenance stage of a low-fat diet. This result was similar to a previous study (Kreuter & Brennan, 1997) that indicated that label users had diets lower in fat and higher in fruits and vegetable intake compared with non-label users.

Perez-Escamilla and Haldeman (2002) investigated whether the relationship between income and dietary quality is modified by food label use among the respondents of the Diet and Health Knowledge Survey (DHKS) who were household meal preparers, meal planners, or food shoppers. They used the Healthy Eating Index, which is a measure of diet quality that assesses conformance to federal dietary guidance to monitor the diet quality of the participants. They found that food label use is associated with improved dietary quality among all income groups. Similarly, Macon, Oakland, Jensen, and Kissack (2004) investigated older American's use of food labels as a tool to moderate dietary risk factors for heart disease using the data from the USDA's Continuous Survey of Food Intakes by Individual (CSFII) 1994-06 and the DHKS from respondents aged 51 years and older. They found the use of food label and percent energy from fat were inversely associated.

Food Photographs as a Tool for Estimation of Portion Sizes

Several studies reported that it is problematic to accurately estimate portion size of food (Guthrie, 1984; Harnack, Steffen, Arnett, Gao, & Luepker, 2004; Bolland, Yuhas-Ward, & Bolland, 1988). However, visual aids, such as food photographs are helpful for individuals to describe the amounts of food eaten (Guthire, 1984; Turconi et al., 2005; Foster et al., 2006; Robson & Livingstone, 2000). Guthrie (1984) investigated whether young adults aged from 18 to 30 year-old could accurately estimate the portion of foods

they selected with or without the aid of photographs. Guthrie found that the estimation could be improved when given picture aids whereas the results were poor without the aids. Robinson and Livingstone (2000) investigated the errors incurred by young adults aged 18 to 36 year-old when single portion size color food prints were provided (100 x 150 mm) as a visual aid to estimate foods consumed at six meals on two non-consecutive days. They reported that between 63% and 80% of participants could correctly estimate their intakes. Turconi et al. (2005) investigated the validity of a color food photography atlas for quantifying portion size eaten by 448 male and female volunteers (6-60 year-old) compared with weighed foods. The participants were given three color food photographs representing three different portion sizes, small, medium and large. There were very small errors between estimated and eaten portion size with color prints; so researchers concluded that the food photograph seemed to be appropriate tool to quantify food proportion sizes in epidemiological dietary surveys.

Conclusion

An obesity epidemic is rapidly increasing and becoming the challenging public health problem in the United States. Increasing portion sizes of food is thought to be one of the contributing factors to the obesity epidemic. The portion size of foods has greatly increased and exceeded the federal standards in the last three decades. Studies have shown that individuals consume more food and calories when portion sizes increase. Also, studies have shown that individuals perceived larger portion sizes as an appropriate amount to eat and did not adjust the amount they consume. Additionally, self-selected portion sizes of some foods significantly exceeded the standard sizes. In order to prevent the portion distortion, the CDC and the USDA recommend people to use food label to be aware the

portion distortions. Label use has been reported to improve diet quality as well as healthy food intake. Finally, several studies have shown that color food photographs, especially with different portions, would be a good tool to quantify the portion sizes individuals generally consume in dietary surveys.

Chapter III: Methodology

Introduction

This chapter includes information about how the sample was selected, a description of the sample, and the instruments being used. In addition, data collection and data analysis procedures were given. The chapter concludes with the methodological limitations.

Subject Selection and Description

The participants of this study were students, both male and female, who are 18 years or older at the University of Wisconsin-Stout who voluntarily participated in the survey at the Student Center at UW-Stout during the data collection period from March to April, 2008. Students who were majoring in nutrition, food science or dietetics were excluded from this study in order to prevent adding another variable to the study that could influence the study outcome. Approval for the Protection of Human Subjects in Graduate Research as well as for conducting this research was obtained from the UW-Stout Institutional Review Board (IRB) prior to beginning any subject involvement (Shown in Appendix A).

Instrumentation

The survey form, consent form, food photographs of portions, and the Nutrition Facts label used as instruments for this study are located in Appendix B, C, D and E, respectively. The survey form of this study was designed to be easy to complete in ten to fifteen minutes. The survey is composed of questions about students' perceptions of portion size that they generally consume, their liking for each food item, degree of hunger, major, gender, age, ethnicity, weight, height, the frequency of reading the serving size and calorie information on the label, the frequency of use of the serving size and calorie information on the food label when consuming food, and students' understanding of serving size

information, as well as the ability to estimate calorie content per food item using the Nutrition Facts label. The food and beverage items contained in the survey were chosen based on the data about popular foods consumed by students. This data came from the University Dining Service Director, Ann Thies and previous studies regarding portion sizes (Burger, Kern, & Coleman, 2007). The food and beverage items selected included pizza with pepperoni, tortilla chips, macaroni and cheese, Cheerios, M&M's, soda, and orange juice. Regarding the questions about portion size of food items, the participants were asked to choose one of four different portion sizes of food that they generally consume using food photographs depicting four different portions. The pictures of each food were taken by a food photographer. Since none of published instruments met the specific needs of this study, the survey questions were developed by the researcher. Also, the food photographs of portions were designed based on the serving size on the Nutrition Facts label of each food item. In the case of solid food, the amount of one serving of each food was set as 1 and then, the others were set at 0.5, 1.5, and 2.0 times smaller or bigger than the amount of one serving as defined on the food label. In the case of soda, the amount of one serving was set as 1 and then, the others were set at 0.5, 1.25, and 2.5 times smaller or bigger than the amount of one serving. In the case of orange juice, the amount of one serving was set as 1 and then, the others were set at 0.5, 1.25, and 1.9 times smaller or bigger than the amount of one serving. Each food portion was labeled with alphabet (A-B-C-D) from the smallest to the largest. The four different portion sizes of each food item are summarized in Table 1.

Table 1

Four Different Portion Sizes of Each Food Items

Food Items	A	B[a]	C	D
Pizza Slice[b]	72 g (1/12 slice)	143 g (1/6 slice)	215 g (1/4 slice)	286 g (1/3 slice)
Macaroni& Cheese[c]	½ cup	1 cup	1 ½ cup	2 cup
Tortilla Chips (74.4 g)[d]	14 g	28 g	42 g	56 g
Soda [e]	4 fl oz (120 mL)	8 fl oz (240 mL)	10 fl oz (300 mL)	15.2 fl oz (591 mL)
M&M's –Peanut (92.7 g)[f]	23 g	46 g	69 g	92 g
Cheerios[g]	½ cup (14 g)	1 cup (28 g)	1 ½ cup (42 g)	2 cup (56 g)
Orange Juice[h]	4 fl oz (120 mL)	8 fl oz (240 mL)	10 fl oz (300 mL)	20 fl oz (450 mL)

[a] Column B represents one serving size listed on the Nutrition Facts label of the food item.
[b] DiGiorno, Kraft Foods Global, Inc. IL. [c] Kraft Foods Global, Inc. IL. [d] Doritos-Nacho Cheese, Frito-Lay, Inc. TX. [e] Mountain Dew, PepsiCo, Inc. NY. [f] Masterfoods USA, NJ. [g] General Mills Cereals, LLC. MN.
[h] Dole 100% juice, PepsiCo, Inc. NY

The students were asked to select one of four pictures that represented the portion size they generally consume. Liking for each food item was determined using a four point Likert Scale (dislike, not very much, somewhat like, and like). The frequency of reading the serving size and calorie information in the Nutrition Facts label were determined by a three point Likert scale (never, sometimes, and always). Similarly, the frequency of use of the serving size and calorie information from the Nutrition Facts label when eating a food item were determined by a three point Likert scale (never, sometimes, and always). Students' understanding of serving size information was determined by the students selecting one of four pictures that represented the serving size that was indicated on the Nutrition Facts label. Food photographs and the Nutrition Facts labels were provided. Each Nutrition Facts label was on the package of each food item. Students' ability to estimate calorie content per food item was determined by asking the student to calculate the calorie content. In the case of soda and orange juice, students were asked to calculate the calorie content when a whole

bottle of the food item was consumed. In the case of M&M's and tortilla chips, students were asked to calculate the calorie content when a whole bag of the food item was consumed. Regarding pizza, macaroni & cheese, and cheerios, students were asked to calculate the calorie content when two servings (slices or cups) of the food item were consumed. A calculator was provided. And lastly, the participants' weight and height were measured with a combination of scale and stadiometer (Detecto) by the researcher and were recorded on the surveys.

Data Collection Procedures

After receiving the approval for conducting the research from the UW-Stout IRB, permission to recruit participants coming to the Students Center and to set a table and two chairs near the cafeteria of the Student Center was obtained from the administrator of the Student Center at the University of Wisconsin-Stout. This study was conducted from March to April, 2008. The Researcher gave participants a brief verbal explanation of how to use food photographs to answer the questions on the survey. The researcher collected all the survey forms and food photographs after students finished answering the questions. (The food photographs were recycled each time).

Data Analysis

Data were analyzed using a computerized statistics package called SPSS Version 15 for Windows. Descriptive statistics were run on the demographic information data, degree of hunger, liking, comparison of the reference sizes with selected portion sizes, frequency of reading the serving size and calorie information, frequency of use of the serving size and calorie information when consuming food, the understanding of serving size information, and the ability to estimate the correct calories of the food items. Means and standard

deviations were also calculated for age and BMI. In addition, correlation analysis was run to examine the effect of each factor on the self-selected portion sizes; however, Chi-square was run for the association of gender with the self-selected portion sizes, the difference in the self-selected portion sizes between liking and dislike, and the difference in the self-selected portion sizes between hunger and non-hunger states.

In order to find the difference between the self-selected portion sizes and the reference sizes, the self-selected portion sizes were compared with the reference sizes. The food photographs were based on one serving size on the Nutrition Facts label, not the reference sizes. The reference sizes of macaroni and cheese, soda, and orange juice were the same as the serving sizes, whereas the reference amounts of pizza slice, tortilla chips, M&Ms, and Cheerios were slightly different from the serving size. The comparisons between the reference sizes and serving sizes of each food item are summarized in Table 2.

Table 2

Comparisons between Reference Sizes and the Serving Sizes on the Nutrition Facts Label of Each Food Item (FDA, Department of Human and Health Services (HHS), 2002)

Food Items	Reference Size	Serving Size on the Nutrition Fact Label
Pizza Slice	140 g	143 g
Macaroni& Cheese	1 cup	1 cup
Tortilla Chips (74.4 g)	30 g	28 g
Soda	240 mL	240 mL
M&M's –Peanut (92.7 g)	40 g	46 g
Cheerios	30 g	28 g
Orange Juice	240 mL	240 mL

Limitations

Known limitations to the study include:

1. The instruments such as survey questions and photographs attached with the survey utilized in this study were developed by the researcher; no measurement of validity or reliability has yet been done.
2. The number of food items examined in this study was limited due to the limited period of time to allow students to complete the survey.
3. The number of different portion sizes examined in this study was limited because of the difficulty to express the portion size differences as a photograph.
4. Some of the participants may not recognize the portion size of food they consume because it may not agree with any of photographs.
5. This study was conducted at only one university; therefore any results should be used cautiously to infer to student populations at other universities.
6. Some participants may not be able to accurately remember the portion sizes due to the indifference to foods or unfamiliarity.
7. Some participants may not estimate calorie content of a food item using calorie information in the Nutrition Facts label due to the lack of math skill.

Chapter IV: Results

This study attempted to determine the difference between the reference sizes and selected portion sizes by students at the University of Wisconsin-Stout. Additional purposes were to examine whether the frequency of reading serving size and calorie information on the Nutrition Facts label, the frequency of use of the serving size and calorie information on the Nutrition Facts label when eating a food item, and the students' understanding of the serving size, as well as the ability to estimate the calorie content per food item using the Nutrition Facts label affect portion sizes selected. The next purpose was to investigate whether body mass index (BMI) was related to portion sizes selected. The last purpose was to examine the difference in portion sizes selected between genders. This study was conducted in the Student Center through a survey and attached photographs of various portions of food items from March 1 to April 3, 2008.

Demographics

The demographics of the participants are summarized in Table 3. There were 112 students enrolled in this survey consisting of 53 male (47.3%) and 59 female (52.7%). The mean age of the participants was 21 years old. Eighty nine participants (79.5%) were age 18 to 22 years-old, 12 participants (10.7%) were 23-24 years old, and 11 participants (9.8%) were 25 or more than 25 years old.

Regarding colleges, this study included 22 students (19.6%) from the College of Arts and Sciences, 30 students (26.8%) from the College of Human Development (except Food and Nutrition Sciences, Dietetics, and Food Systems), 45 students (40.2%) from the College of Technology, Engineering and Management, 14 students (12.5%) from the School of Education, and one student who didn't report his or her college (0.9%).

Regarding classification, of the 112 participants, there were 23 freshman students (20.5%), 29 sophomore students (25.9%), 22 junior students (19.6%), 33 senior students (29.5%), and 5 graduate students (4.5%). Regarding ethnicity, this study included 83 Caucasians (74.1%), two African Americans (1.8%), 12 Asian Americans (10.7%), one Hispanic (0.9%), 11 Asians (9.8%), and three students who didn't report their ethnicities (2.7%). Their mean Body Mass Index (BMI) was 24.96. Two participants (1.8%) were categorized as underweight; 67 participants (59.8%) were categorized as normal; 27 participants (24.1%) were categorized as overweight; and 16 participants (14.3%) were categorized as obese.

Table 3

Characteristics of Participants' Demographics (N=112): Descriptive Statistics

Category		Number (N)	Percentage (%)
Gender			
	Female	59	52.7
	Male	53	47.3
Age (mean=21.25)			
	18-22	89	79.5
	23-24	12	10.7
	≥ 25	11	9.8
College			
	College of Arts and Sciences	22	19.6
	College of Human Development	30	26.8
	College of Technology, Engineering and Management	45	40.2
	School of Education	14	12.5
	Unreported	1	0.9
Status			
	Freshman	23	20.5
	Sophomore	29	25.9
	Junior	22	19.6
	Senior	33	29.5
	Graduate	5	4.5

Table 3 Continued

Category		Number (N)	Percentage (%)
Race			
	Caucasian	83	74.1
	African American	2	1.8
	Asian American	12	10.7
	Hispanic	1	0.9
	Asian	11	9.8
	Unreported	3	2.7
BMI (mean=24.96)			
	<18.5	2	1.8
	18.5-24.9	67	59.8
	25.0-29.9	27	24.1
	30.0 ≤	16	14.3

Degree of Hunger at the Moment of the Survey

The degree of hunger is summarized in Table 4. Participants were asked their degree of hunger. Three participants (2.7%) reported "very hungry", 15 participants (12.4%) reported "hungry", 38 participants (33.9%) reported "somewhat hungry", and 56 participants (50.0%) reported "not hungry."

Table 4

Degree of Hunger at the Moment of the Survey (N=112): Descriptive Statistics

Categories	Number (N)	Percentage (%)
Very Hungry	3	2.7
Hungry	15	13.4
Somewhat Hungry	38	33.9
Not Hungry	56	50.0

Liking of Food Items

The liking of food items are summarized in Table 5. The questions one, three, five, seven, nine, 11, and 13 of the first segment on the survey stated "How much do you like or dislike this food item?" If participants didn't eat the food item(s), they skipped the section(s).

Regarding the pizza slice, one participant (0.9%) reported "dislike," five participants (4.5%) reported "not very much," 26 participants (23.4%) reported "somewhat like," and 79 participants (70.5%) reported "like." Only one participant (0.9%) did not generally consume or did not report their liking of the pizza slice.

Three participants (2.7%) reported "dislike," 10 participants (8.9%) reported "not very much," 43 participants (38.4%) reported "somewhat like," and 49 participants (43.8%) reported "like" for macaroni and cheese. Seven (6.3%) did not generally consume or did not report their liking of macaroni and cheese.

Ten participants (8.9%) reported "not very much," 49 participants (43.8%) reported "somewhat like," and 49 participants (43.8%) reported "like" for tortilla chips. Four (3.6%) did not generally consume or did not indicate their liking of tortilla chips.

Regarding soda, nine participants (8.0%) reported "dislike," 16 participants (14.3%) reported "not very much," 15 participants (13.4%) reported "somewhat like," and 57 participants (50.9%) reported "like." Fifteen (13.4%) did not generally consume or did not report their liking of soda.

Three participants (2.7%) reported "dislike," 10 participants (8.9%) reported "not very much," 33 participants (29.5%) reported "somewhat like," and 65 participants (58.0%)

reported "like" for M&M's. Only one participant (0.9%) did not generally consume or report their liking of M&M's.

Two participants (1.8%) reported "dislike," 20 participants (17.9%) reported "not very much," 34 participants (30.4%) reported "somewhat like," and 52 participants (46.4%) reported "like" for Cheerios (before pouring milk). Four participants (3.6%) did not generally consume or did not report their liking of Cheerios.

Four participants (3.6%) reported "dislike," three participants (2.7%) reported "not very much," 21 participants (18.8%) reported "somewhat like," and 84 participants (75.0%) reported "like" for orange juice. There was no participant (0.0%) who did not generally consume or did not report their liking of orange juice.

Table 5

Liking of Food Items (N=112): Descriptive Statistics

How much do you like or dislike this food item?		
Pizza Slice:		
Category	Number (N)	Percentage (%)
Dislike	1	0.9
Not Very Much	5	4.5
Somewhat Like	26	23.2
Like	79	70.5
Not Consumed or Unreported	1	0.9
Macaroni & Cheese:		
Category	Number (N)	Percentage (%)
Dislike	3	2.7
Not Very Much	10	8.9
Somewhat Like	43	38.4
Like	49	43.8
Not Consumed or Unreported	7	6.3

Table 5 Continued

Tortilla Chips:		
Category	Number (N)	Percentage (%)
Not Very Much	10	8.9
Somewhat Like	49	43.8
Like	49	43.8
Not Consumed or Unreported	4	3.6
Soda:		
Category	Number (N)	Percentage (%)
Dislike	9	8.0
Not Very Much	16	14.3
Somewhat Like	15	13.4
Like	57	50.9
Not Consumed or Unreported	15	13.4
M&Ms:		
Category	Number (N)	Percentage (%)
Dislike	3	2.7
Not Very Much	10	8.9
Somewhat Like	33	29.5
Like	65	58.0
Not Consumed or Unreported	1	0.9
Cheerios (Before pouring milk):		
Category	Number (N)	Percentage (%)
Dislike	2	1.8
Not Very Much	20	17.9
Somewhat Like	34	30.4
Like	52	46.4
Not Consumed or Unreported	4	3.6
Orange Juice:		
Category	Number (N)	Percentage (%)
Dislike	4	3.6
Not Very Much	3	2.7
Somewhat Like	21	18.8
Like	84	75.5
Not Consumed or Unreported	0	0.0

Comparisons of Students' Selected Portion Sizes with the Reference Sizes

The comparison of students' selected portion sizes with the reference sizes is summarized in Table 6. Also, these results are expressed in Figure 1 as a percentage after taking out the non-respondents. Questions two, four, six, eight, 10, 12, and 14 on the survey stated "Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size". The food photographs of portions were designed based on the serving size on the Nutrition Facts label of each food item. In the case of solid food, the amount of one serving of each food was set as 1 and then, the others were set at 0.5, 1.5, and 2.0 times smaller or bigger than the amount of one serving. In the case of soda, the amount of one serving was set as 1 and then, the others were set at 0.5, 1.25, and 2.5 times smaller or bigger than the amount of one serving. In the case of orange juice, the amount of one serving was set as 1 and then, the others were set at 0.5, 1.25, and 1.9 times smaller or bigger than the amount of one serving. Each food portion was labeled with alphabet (A-B-C-D) from the smallest to the largest. The students were asked to select one of four pictures that represented the portion size they generally consume. Then, the portion selected by student was compared to the FDA reference size of the food items. The reference sizes of macaroni and cheese, soda, and orange juice were the same as the one serving size of each food item whereas the reference sizes of pizza slice, tortilla chips, M&Ms, and Cheerios were slightly different from the serving size found on the Nutrition Facts label.

Regarding pizza slice, the reference size is 140 g (FDA, HHS, 2002), whereas the one serving size of pizza from the label is 143 g, 1/6 pizza (DiGiorno, Kraft Foods Global, Inc. IL.). For data analysis, "0.51," smaller or "1.02," "1.53," and "2.04" times larger than

the reference sizes were coded as 1, 2, 3, and 4, respectively. Three participants (2.7%) selected 0.51 times smaller than the reference size, 22 participants (19.8%) selected the 1.02 times larger portion size than the reference, 36 participants (32.4%) selected 1.53 times larger portion size, and 50 participants (45.0%) selected 2.04 times larger portion size than the reference size. Only one participant (0.9%) did not consume or did not report their liking of pizza slice.

Regarding macaroni & cheese, the reference size is 1 cup (FDA, HHS, 2002) that is as same as the one serving size from the label (Macaroni & Cheese-The Cheesiest Original Flavor, Kraft Foods Global, Inc. IL.). For data analysis, "0.5,"smaller or "1," "1.5," and "2.0" times larger than the reference sizes were coded as 1, 2, 3, and 4, respectively. Eleven participants (9.8%) selected 0.5 times smaller than the reference size, 45 participants (40.2%) selected the same size as the reference, 36 participants (32.1%) selected 1.5 times larger portion size, and 13 participants (11.6%) selected 2.0 times larger portion size than the reference size. Seven (6.3%) did not consume or did not report their liking of macaroni and cheese.

For tortilla chips, the reference size is 30 g (FDA, HHS, 2002) whereas the one serving size from the label is 28 g (Doritos-Nacho Cheese, Frito-Lay, Inc. TX.). For data analysis, "0.47" and "0.93" smaller or "1.40," and "1.87" times larger than the reference size were coded as 1, 2, 3, and 4, respectively. Nineteen participants (17.0%) selected 0.47 times smaller than the reference size, 42 participants (37.5 %) selected 0.93 times smaller than reference size, 36 participants (32.1 %) selected the 1.4 times larger portion size, and 11 participants (9.8%) selected the 1.87 times larger portion size than the reference size. Four (3.6%) did not consume or did not indicate their liking of tortilla chips.

The reference size for soda is 240 ml (FDA, HHS, 2002) which is as same as the one serving size from the label (Mountain Dew, Pepsi Co, Inc). For data analysis, "0.50," smaller or "1," "1.25," and "2.5" times larger than the reference sizes were coded. Fifteen participants (13.4%) selected 0.5 times smaller than the reference size, 15 participants (13.4%) selected the same size as the reference size, 30 participants (26.8 %) selected 1.25 times larger portion size, and 37 participants (33.0%) selected 2.5 times larger portion size than the reference sizes. Fifteen (13.4%) did not consume or did not report their liking of soda.

The reference size for M&M's is 40 g (FDA, HHS, 2002) whereas the one serving size as indicated on the label is 46 g (M&M's – Peanut, Masterfoods USA, NJ.). For data analysis, "0.58" smaller or "1.15," "1.73," and "2.23" times larger than the reference size were coded. Twenty three participants (20.5%) selected 0.58 times smaller than the reference size, 45 participants (40.2 %) selected 1.15 times larger than the reference, 29 participants (25.9 %) selected 1.73 times larger portion size, and 14 participants (12.5%) selected 2.3 times larger portion size than the reference sizes. Only one participant (0.9%) did not consume or report their liking of M&M's.

Regarding Cheerios, the reference size is 30 g (FDA, HHS, 2002) whereas the one serving size from the label is 28 g (General Mills Cereals, LLC. MN). For data analysis, "0.47," and "0.93" smaller or "1.40," and "1.87" times larger than the reference size were coded. Nineteen participants (17.0%) selected 0.47 times smaller than the reference size, 45 participants (40.2 %) selected 0.93 times smaller than the reference, 30 participants (26.8 %) selected 1.4 times larger portion size, and 14 participants (12.5%) selected 1.87 times larger

portion size than the reference sizes. Four did not consume or report their liking for Cheerios.

The reference size for orange juice is 240 ml (FDA, HHS, 2002); that is as same as the one serving size as indicated on the label (Dole 100% juice, PepsiCo, Inc. NY.). For data analysis, "0.50,"smaller or "1," "1.25," and "1.9" times larger than the reference sizes were coded as 1, 2, 3, and 4, respectively. Ten participants (8.9%) selected 0.5 times smaller than the reference size, 18 participants (16.1%) selected the same size as the reference, 27 participants (24.1 %) selected 1.25 times larger portion size, and 57 participants (50.9%) selected 1.9 times larger portion size than the reference sizes. There was no participant (0.0%) who did not consume or did not report their liking of orange juice.

Table 6

Comparisons of Students' Portion Sizes with the Reference Sizes (N=112): Descriptive Statistics

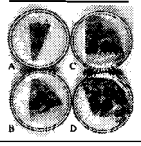
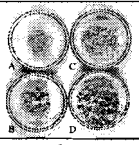
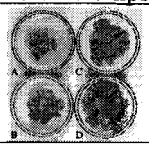
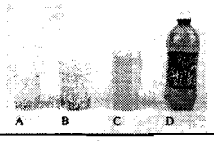
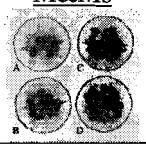
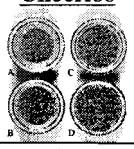
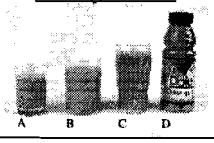
Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size			
Food Items	% Reference Size	Number (N)	Percentage (%)
Pizza Slice 	51%	3	2.7
	102%	22	19.6
	153%	36	32.1
	204%	50	44.6
	Not consumed or Unreported	1	0.9
Food Items	% Reference Size	Number (N)	Percentage (%)
Macaroni & Cheese 	50%	11	9.8
	100%	45	40.2
	150%	36	32.1
	200%	13	11.6
	Not consumed or Unreported	7	6.3
Food Items	% Reference Size	Number (N)	Percentage (%)
Tortilla Chips 	47%	19	17.0
	93%	42	37.5
	140%	36	32.1
	187%	11	9.8
	Not consumed or Unreported	4	3.6

Table 6 Continued

Food Items	% Reference Size	Number (N)	Percentage (%)
Soda 	50%	15	13.4
	100%	15	13.4
	125%	30	26.8
	250%	37	33.0
	Not consumed or Unreported	15	13.4
Food Items	% Reference Size	Number (N)	Percentage (%)
M&Ms 	58%	23	20.5
	115%	45	40.2
	173%	29	25.9
	230%	14	12.5
	Not consumed or Unreported	1	0.9
Food Items	% Reference Size	Number (N)	Percentage (%)
Cheerios 	47%	19	17.0
	93%	45	41.7
	140%	30	26.8
	187%	14	12.5
	Not consumed or Unreported	4	3.6
Food Items	% Reference Size	Number (N)	Percentage (%)
Orange Juice 	50%	10	8.9
	100%	18	16.1
	125%	27	24.1
	190%	57	50.9
	Not consumed or Unreported	0	0.0

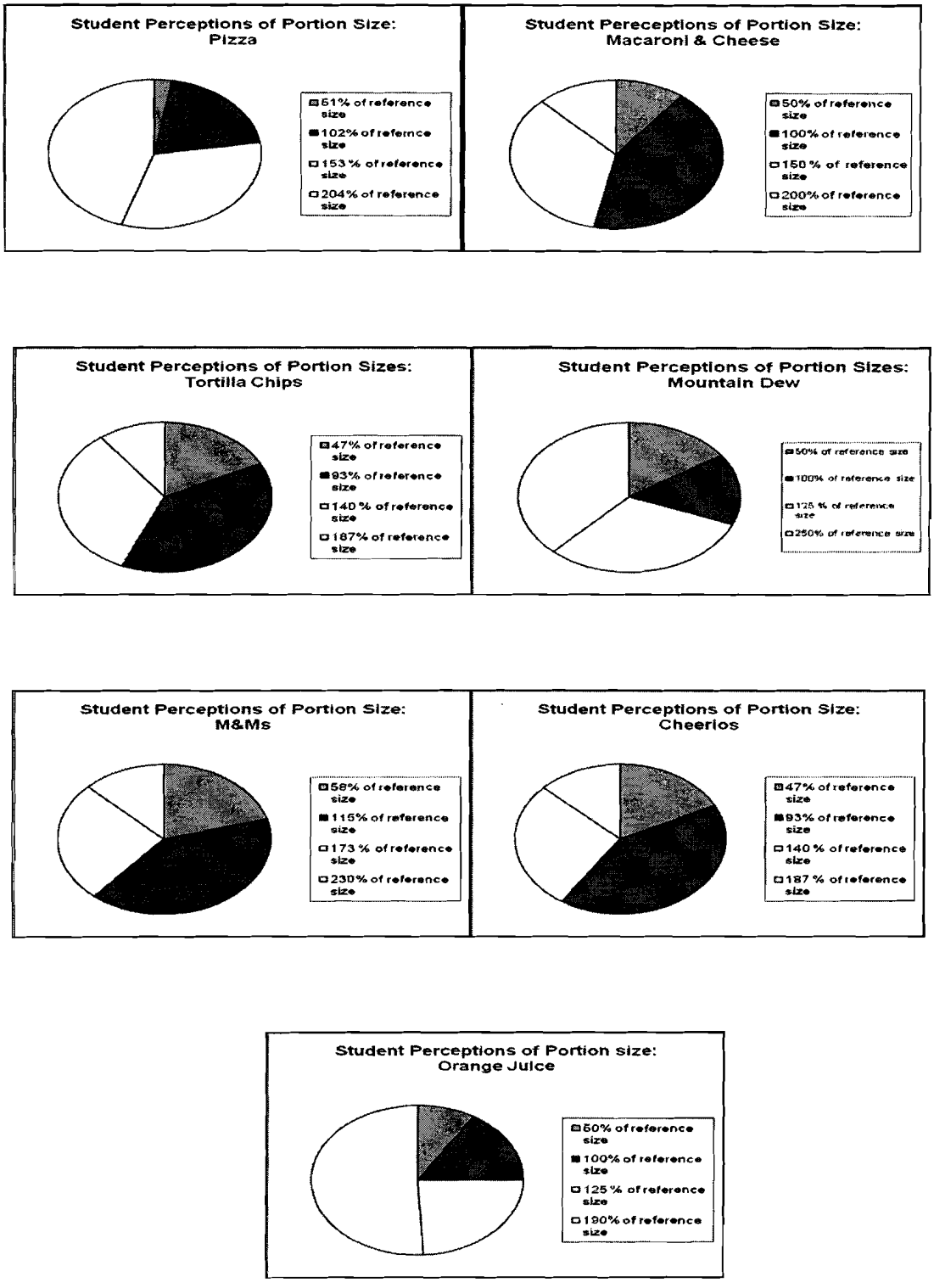


Figure 1 Comparisons of students' selected portion sizes with the reference sizes (N=112) (The result was expressed by percentage of respondents; Non-respondents were not included.)

Frequency of Reading or Using the Nutrition Facts Label

Frequency of reading or using the Nutrition Facts label is summarized in Table 7. Question one of the second segment on the survey stated "How often do you read the serving size information of food on the Nutrition Facts label?" Eighteen participants (16.1%) selected "never," 61 participants (54.5%) selected "sometimes," and 33 participants (29.5%) selected "always."

Question two of the second segment on the survey stated "How often do you read the amount of calories in a food on the Nutrition Facts label?" Twenty four participants (21.4%) selected "never," 54 participants (48.2%) selected "sometimes," and 34 participants (30.4%) selected "always."

Question three of the second segment on the survey stated "When you eat a food item, do you use the serving size information on the Nutrition Facts label to help you fit that food into your daily diet?" Fifty four participants (48.2%) selected "never," 50 participants (44.6%) selected "sometimes," and eight participants (7.1%) selected "always."

Question four of the second segment on the survey stated "When you eat a food item, do you use the calorie information on the Nutrition Facts label to help you fit that food into your daily diet?" Forty nine participants (43.8%) selected "never," 48 participants (42.9 %) selected "sometimes," and 15 participants (13.4%) selected "always."

Table 7

Frequency of Reading or Using the Nutrition Facts Label: Descriptive Statistics

Category	Number (N)	Percentage (%)
1. How often do you READ the serving size information of food on the Nutrition Facts label?		
Never	18	16.1
Sometimes	61	54.5
Always	33	29.5
2. How often do you READ the amount of calories in a food on the Nutrition Facts label?		
Never	24	21.4
Sometimes	54	48.2
Always	34	30.4
3. When you eat a food item, do you USE the serving size information on the Nutrition Facts label to help you fit that food into your daily diet?		
Never	54	48.2
Sometimes	50	44.6
Always	8	7.1
4. When you eat a food item, do you USE the calorie information on the Nutrition Facts label to help you fit that food into your daily diet?		
Never	49	43.8
Sometimes	48	42.9
Always	15	13.4

Understanding of Serving Size Information on the Nutrition Facts Label

Understanding of serving size and the ability to estimate calorie information is summarized in Table 8. Questions one, three, five, seven, nine, 11, and 13 of the last segment on the survey stated "Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size." For data analysis, "0.5" times smaller or "1", "1.5", and "2" times larger than the serving size of pizza were coded as 1, 2, 3, and 4, respectively. Then, these items were recoded as "correct" if the code was "2," or "incorrect" if the code number was a number other than "2."

Regarding pizza slice, 34 participants (30.4%) didn't correctly identify the serving size, whereas 77 participants (68.8%) correctly identified the serving size. Fifty five participants (49.1%) didn't correctly identify the serving size of macaroni and cheese, whereas 57 participants (50.9%) correctly identified the serving size. Forty eight participants (42.9%) didn't correctly identify the serving size of tortilla chips, whereas 64 participants (57.1%) correctly identified the serving size. Similarly, 60 participants (53.6%) didn't correctly identify the serving size of soda, whereas 52 participants (46.4%) correctly identified the serving size.

Regarding M&Ms, Cheerios, and orange juice, 44 (39.3%), 86 (76.8%), and 42 participants (37.5%), respectively, didn't correctly identify the serving size, whereas 68 (60.7%), 26 (23.2%), and 70 participants (62.5%), respectively, correctly identified the serving size.

Table 8

Understanding of Serving Size Information on the Nutrition Facts Label: Descriptive Statistics of Percentages of Answering Correctly or Incorrectly

Category	Number (N)	Percentage (%)
Pizza Slice		
1. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size:		
Incorrect	34	30.6
Correct	77	69.4
Macaroni & Cheese		
2. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size:		
Incorrect	55	49.1
Correct	57	50.9

Table 8 Continued

Tortilla Chips		
3. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size:		
Incorrect	48	42.9
Correct	64	57.1
Soda		
4. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size		
Incorrect	60	53.6
Correct	52	46.4
M&M's		
5. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size		
Incorrect	44	39.3
Correct	68	60.7
Cheerios* before pouring milk		
6. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size		
Incorrect	86	76.8
Correct	26	23.2
Orange Juice		
7. Please identify the portion of this food item that is indicated on the Nutrition Facts label as a serving and check the letter from the picture which represents that size		
Incorrect	42	37.5
Correct	70	62.5

Ability to Estimate the Calorie Content Using the Nutrition Facts Label

The ability to estimate the calorie content using the Nutrition Facts label is summarized in Table 9. Question two (pizza slice) of the last segment on the survey stated "How many calories would you consume if you ate two slices?" For data analysis, the calories estimated by the participants were entered and then classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 660 calories, it was coded as "correct." If the answer was other than 660 calories; the item was coded as "incorrect." However, if the answer was within plus or minus 10% of the correct answer, it was also coded "correct." Eighteen participants (16.1%) could not correctly estimate the calories of pizza whereas 94 participants (83.9%) correctly estimated the calories.

Question four (macaroni and cheese) of the last segment on the survey stated "How many calories would you consume if you ate two cups?" For data analysis, the calories estimated by the participants were entered and then classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 820 calories, it was coded as "correct." If the answer was other than 820 calories, the item was coded as "incorrect." However, if the answer was within plus or minus 10% of the correct answer, it was also coded "correct." Seventy eight participants (69.6%) could not correctly estimate the calories, whereas 34 participants (30.4%) correctly estimated the calories.

Question six (tortilla chips) of the last segment on the survey stated "How many calories would you consume if you ate a whole bag?" For data analysis, the calories estimated by the participants were entered and then classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 390 calories, it was coded as "correct." If the answer was other than 390 calories; the item was coded as "incorrect." However, if the answer was within plus or minus 10% of the correct answer, it was also coded "correct." Thirty five participants (31.3%) could not correctly estimate the calories, whereas 77 participants (68.8%) correctly estimated the calories.

Question eight (soda) of the last segment on the survey stated "How many calories would you consume if you drank a whole bottle?" For data analysis, the calories estimated by the participants were entered and then classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 275 calories, it was coded as "correct." If the answer was other than 275 calories; the item was coded as "incorrect." However, if the answer was within plus or minus 10% of the correct answer, it was also coded "correct."

Twenty nine participants (25.9%) could not correctly estimate the calories, whereas 83 participants (74.1%) correctly estimated the calories.

Question 10 (M&Ms) of the last segment on the survey stated "How many calories would you consume if you ate a whole bag?" For data analysis, the calories estimated by the participants were entered and then classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 480 calories, it was coded as "correct." If the answer was other than 480 calories; the item was coded as "incorrect." However, if the answer was within plus minus 10% of the correct answer, it was also coded "correct." Twenty participants (17.9%) could not correctly estimate the calories, whereas 92 participants (82.1%) correctly estimated the calories.

Question 12 (Cheerios) of the last segment on the survey stated "How many calories would you consume if you ate two cups?" For data analysis, the calories estimated by the participants were entered and then classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 200 calories, it was coded as "correct." If the answer was other than 200 calories; the item was coded as "incorrect." However, if the answer was within plus minus 10% of the correct answer, it was also coded "correct." Sixteen participants (14.3%) could not correctly estimate the calories, whereas 96 participants (85.3%) correctly estimated the calories.

Question 14 (orange juice) of the last segment on the survey stated "How many calories would you consume if you drank a whole bottle?" For data analysis, the calories estimated by the participants were entered and then were classified either "correct" or "incorrect." At first, all answers were entered. If the answer was 210 calories, it was coded as "correct." If the answer was other than 210 calories; the item was coded as "incorrect."

However, if the answer was within plus minus 10% of the correct answer, it was also coded "correct." Six participants (5.4%) could not correctly estimate the calories, whereas 106 participants (94.6%) correctly estimated the calories.

Table 9

Ability to Estimate Calorie Content of Food using the Nutrition Facts Label: Descriptive Statistics

Category	Number (N)	Percentage (%)*
Pizza Slice (Question 2)		
How many calories would you consume if you ate two slices of pizza?		
Incorrect	18	16.1
Correct	94	83.9
Macaroni & Cheese (Question 4)		
How many calories would you consume if you ate two cups?		
Incorrect	78	69.6
Correct	34	30.4
Tortilla Chips (Question 6)		
How many calories would you consume if you ate a whole bag?		
Incorrect	35	31.3
Correct	77	68.8
Soda (Question 8)		
How many calories would you consume if you drank a whole bottle?		
Incorrect	29	25.9
Correct	83	74.1
M&M's (Question 10)		
How many calories would you consume if you ate a whole bag?		
Incorrect	20	17.9
Correct	92	82.1
Cheerios* before pouring milk (Question 12)		
How many calories would you consume if you ate two cups?		
Incorrect	16	14.3
Correct	96	85.7
Orange Juice (Question 14)		
How many calories would you consume if you drank a whole bottle?		
Incorrect	6	5.4
Correct	106	94.6

* Percentages of answering correct or incorrectly

Association of the Gender Difference with Selected Portion Sizes

The association of the gender difference with selected portion sizes is summarized in Table 10. Pearson Chi-Square was run to examine the association of the gender difference with portion sizes selected by students. The results indicated that there was a significant difference in the self-selected portion sizes of pizza (p=0.001) as well as the portion sizes of Mountain Dew (p=0.007) between gender. More males selected the largest portion of pizza slice (2.04 times larger than the reference) and Mountain Dew (2.5 times larger than reference size) than females. More females selected the 1.02 and 1.53 times larger than the reference size of pizza as well as 1.0 and 1.25 times larger than the reference size of Mountain Dew than the males.

Table 10

Association of the Gender Difference with Selected Portion Sizes: Pearson Chi-Square Analysis

Food Item		Frequency				P-value
Pizza		51%	102%	153%	204%	0.001*
	Male	0	5	12	36	
	Female	3	17	24	14	
Macaroni & Cheese		50%	100%	150%	200%	0.183
	Male	6	20	16	10	
	Female	5	25	20	3	
Tortilla Chips		47%	93%	140%	187%	0.471
	Male	9	17	21	5	
	Female	10	25	15	6	

Table 10 Continued

Soda		50%	100%	125%	250%	0.007*
	Male	6	4	11	26	
	Female	9	11	19	11	
M&Ms		58%	115%	173%	204%	0.496
	Male	9	20	14	9	
	Female	14	25	15	5	
Cheerios		51%	93%	153%	204%	0.054
	Male	7	17	18	10	
	Female	12	28	12	4	
Orange Juice		51%	100%	153%	204%	0.058
	Male	1	7	14	31	
	Female	9	11	13	26	

* indicates significant difference ($P < 0.01$)

Association of the BMI with Selected Portion Sizes

The association of the BMI with selected portion sizes is summarized in Table 11. Pearson correlation analysis was run to examine the association of the BMIs with portion sizes selected by students. The results indicated that there was a significantly positive correlation between BMI and the portion size of Mountain Dew ($r=0.20$, $p=0.049$).

Table 11

Association of the BMI with Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	0.005	0.955
Macaroni & Cheese	- 0.005	0.964
Tortilla Chips	-0.090	0.357
Soda	0.200	0.049*

Table 11 Continued

M&Ms	0.038	0.695
Cheerios	0.133	0.17
Orange Juice	0.093	0.330

* indicates that correlation is significant (P <0.05)

Difference in the Selected Portion Sizes between Hunger and Non-Hunger States

The difference in the selected portion sizes between participants' hunger and non-hunger state is summarized in Table 12. Pearson Chi-Square was run to examine the difference in the selected portion sizes between hunger and non-hunger states. The results indicated that there was no significant difference in the selected portion sizes between the hunger and the non-hunger states.

Table 12

The Difference in the Selected Portion Sizes between Hunger and Non-Hunger States: Pearson Chi-Square Analysis

Food Item		Frequency				P-value
Pizza		51%	102%	153%	204%	0.246
	Not Hungry	3	13	17	23	
	Hungry	0	9	19	17	
Macaroni & Cheese		50%	100%	150%	200%	0.486
	Not Hungry	4	20	21	7	
	Hungry	7	25	15	6	
Tortilla Chips		47%	93%	140%	187%	0.476
	Not Hungry	11	17	20	5	
	Hungry	8	25	16	6	

Table 12 Continued

Soda		50%	100%	125%	250%	0.092
	Not Hungry	8	12	12	19	
	Hungry	7	3	18	18	
M&Ms		58%	115%	173%	204%	0.565
	Not Hungry	13	24	13	5	
	Hungry	10	21	16	9	
Cheerios		47%	93%	140%	187%	0.105
	Not Hungry	12	19	18	4	
	Hungry	7	26	12	0	
Orange Juice		50%	100%	125%	190%	0.714
	Not Hungry	5	9	16	26	
	Hungry	5	9	11	31	

Difference in the Selected Portion Sizes between Liking and Not-Liking

The difference in the selected portion size between liking and disliking is summarized in Table 13. Pearson Chi-Square was run to examine the difference in the selected portion sizes between liking and not-liking. The results indicated that there was a significant difference in the selected portion sizes of all food items between liking and not-liking. Participants liking of food items resulted in larger self-selected portion sizes for all items.

Table 13

The Difference in the Selected Portion Sizes between Liking and Not-Liking: Pearson Chi-Square Analysis

Food Item		Frequency				P-value
Pizza		51%	102%	153%	204%	0.001**
	Not Liking	2	3	0	1	
	Liking	1	19	36	49	
Macaroni & Cheese		50%	100%	150%	200%	0.001**
	Not Liking	5	7	1	0	
	Liking	6	38	35	13	
Tortilla Chips		47%	93%	140%	187%	0.023*
	Not Liking	5	4	1	0	
	Liking	14	38	35	11	
Soda		50%	100%	125%	250%	0.001**
	Not Liking	10	9	5	1	
	Liking	5	6	25	36	
M&Ms		58%	115%	173%	204%	0.001**
	Not Liking	11	1	1	0	
	Liking	12	44	28	14	
Cheerios		47%	93%	140%	187%	0.003*
	Not Liking	9	10	3	0	
	Liking	10	35	27	14	
Orange Juice		50%	100%	125%	190%	0.001**
	Not Liking	4	0	1	2	
	Liking	6	18	26	55	

** indicates significant difference (P <0.01)
* indicates significant difference (P <0.05)

Association of Frequency of Reading of the Serving Size Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

The association of frequency of reading the label with the self-selected portion sizes is summarized in Table 14. Pearson correlation analysis was run to examine the association of the frequency of reading of the serving size information with portion sizes selected by students. The results indicated that there was no significant correlation between frequency of reading of the serving size information and the self-selected portion size.

Table 14

Association of Frequency of Reading of the Serving Size Information on the Nutrition Facts Label with the Self-Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	-0.061	0.525
Macaroni & Cheese	-0.133	0.175
Tortilla Chips	-0.141	0.145
Soda	-0.123	0.228
M&Ms	-0.95	0.319
Cheerios	-0.012	0.903
Orange Juice	-0.156	0.100

Association of Frequency of Reading the Calorie Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

The association of frequency of reading the calorie information on the Nutrition Facts label with the self-selected portion sizes is summarized in Table 15. Pearson correlation analysis was run to examine the association of the frequency of reading of the calorie information with portion sizes selected by students. The results indicated that there

was no significant correlation between the frequency of reading of the serving size information and the self-selected portion size.

Table 15

Association of Frequency of Reading the Calorie Information on the Nutrition Facts Label with the Self-Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	-0.089	0.355
Macaroni & Cheese	-0.173	0.077
Tortilla Chips	-0.050	0.608
Soda	-0.099	0.335
M&Ms	-0.086	0.368
Cheerios	-0.053	0.586
Orange Juice	-0.159	0.094

Association of Frequency of Use of the Serving Size Information on the Nutrition Facts Label when Consuming Food with the Self-Selected Portion Sizes

The association of frequency of use of the serving size information on the Nutrition Facts label when consuming food with the self-selected portion sizes is summarized in Table 16. Pearson correlation analysis was run to examine the association of the frequency of use of the serving size information when consuming food with the portion sizes selected by students. The results indicated that there were significant negative correlations between the frequency of use of serving size information and selected portion sizes of tortilla chips ($r = -0.208$, $p = 0.031$) and M&Ms ($r = -0.189$, $p = 0.047$).

Table 16

Association of Frequency of Use of the Serving Size Information on the Nutrition Facts Label when Consuming Food with the Self-Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	-0.101	2.93
Macaroni & Cheese	-0.113	0.251
Tortilla Chips	-0.208	0.031*
Soda	-0.162	0.112
M&Ms	-0.189	0.047*
Cheerios	0.035	0.633
Orange Juice	-0.132	0.164

*Correlation is significant ($p < 0.05$)

Association of Frequency of Use of the Calorie Information on the Nutrition Facts Label When Consuming Food with the Self-Selected Portion Sizes

The association of frequency of use of the calorie information on the Nutrition Facts label when consuming food with the self-selected portion sizes is summarized in Table 17. Pearson correlation analysis was run to examine the association of the frequency of use of the calorie information when consuming food with portion sizes selected by students. The results indicated that there was no significant correlation between frequency of use of calorie information when consuming food and the self-selected portion size.

Table 17

Association of Frequency of Use of the Calorie Information on the Nutrition Facts Label when Consuming Food with the Self-Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	-0.157	0.100
Macaroni & Cheese	-0.155	0.115
Tortilla Chips	-0.083	0.382
Soda	-0.168	0.099
M&Ms	-0.040	0.676
Cheerios	0.046	0.633
Orange Juice	-0.171	0.072

Association of Understanding the Serving Size Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

The association of understanding the serving size information on the Nutrition Facts label with the self-selected portion sizes is summarized in Table 18. Understanding the serving size information was determined by the percent correctly answered. Correct answers of each participant were added up; and then divided by seven, the total number of food items to determine the percent correct answer. Pearson correlation analysis was run to examine the association of the understanding the serving size information with portion sizes selected by students. The results indicated that there were significant positive correlations between the understanding of serving size and selected portion sizes of macaroni and cheese ($r = 0.215$, $p = 0.027$) and Cheerios ($r = 0.232$, $p = 0.016$).

Table 18

Association of Understanding the Serving Size Information on the Nutrition Facts Label with the Self-Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	0.126	0.187
Macaroni & Cheese	0.215	0.027*
Tortilla Chips	0.022	0.821
Soda	0.066	0.520
M&Ms	0.160	0.092
Cheerios	0.232	0.016*
Orange Juice	-0.062	0.514

*. Correlation is significant ($p<0.05$)

Association of Ability to Estimate Calorie Content Using the Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

The association of the ability to estimate calorie content using the information on the Nutrition Facts label with the self-selected portion sizes is summarized in Table 19. The ability to estimate calorie content was determined by the percent correctly answered. Correct answers of each participant were added up; and then divided by seven, the total number of food items to determine the percent correctly answered. Pearson correlation analysis was run to examine the association of the ability to estimate calorie content with portion sizes selected by students. The results indicated that there were significant positive correlations between the ability to estimate calorie content and selected portion sizes of pizza ($r=0.261$, $p=0.006$) and macaroni and cheese ($r=0.2324$, $p=0.016$).

Table 19

Association of Ability to Estimate Calorie Content Using the Information on the Nutrition Facts Label with the Self-Selected Portion Sizes: Pearson Correlation

Food Item	Pearson Correlation (r)	P-value
Pizza	0.261	0.006**
Macaroni & Cheese	0.234	0.016*
Tortilla Chips	-1.03	0.287
Soda	0.102	0.321
M&Ms	0.085	0.374
Cheerios	0.098	0.311
Orange Juice	-0.017	0.856

** Correlation is significant ($p<0.01$).

*Correlation is significant ($p<0.05$).

Chapter V: Discussion

Summary

The underlying purpose of this study was to investigate whether students' use of the Nutrition Facts label would affect students' selection of portion sizes of food. In order to achieve this purpose, comparisons of self-selected portion sizes with the reference amount, examination of the frequency of reading serving size and calorie information on the Nutrition Facts label, the frequency of use of the serving size and calorie information when eating a food item, and students' understanding of serving size and the ability to estimate calorie content through using the Nutrition Facts label were done. Additionally, this study investigated the association of the gender difference with the selected portion sizes as well as the association between students' BMI and the selected portion sizes. This research found that approximately 40% or more students selected larger portion sizes compared to the reference sizes. Over 75% of students read the Nutrition Facts label, whereas over 50% of students used the label when consuming food. Regarding students' understanding of serving size information as well as their ability to estimate calorie content, over 45% of students correctly selected the serving size of most of the foods, whereas over 65% of students estimated the correct amount of calories from most of the foods. The frequency of use the calorie information, the understanding of serving size information, and the ability to correctly estimate the amount of calories did not affect the selection of portion sizes. However, the frequency of use of serving size information with awareness of health helped students to select smaller portion sizes of some snacks.

Demographics

There were almost equal numbers of female (n=59) and male (n=53) students in this study. The age of students primarily fell in the age group between 18 and 22 years-old. The participants were primarily undergraduate, Caucasian students. Mean BMI for all participants was 24.96. Almost 60% of the participants were categorized in the healthy weight range, whereas 38.4% of students were categorized as overweight or obese.

Comparisons of Self-Selected Portion Sizes with the Reference Sizes

In regard to the research question, "Are portion sizes selected by students different from the reference portion sizes?" this study found that approximately 40% or more of the participants selected larger portions of every food item compared with the reference sizes. Out of seven food items, about 70% or more participants selected larger portion sizes of pizza slice (77.45%), orange juice (75%), and soda (69%), than the reference sizes. This result was similar to a previous research study, in which Burger, Kern, and Coleman (2007) found that students selected larger portions of macaroni and cheese, M&M's and tortilla chips than the reference sizes. Also, another study (Colapinto, Fitzgerald, Taper, & Veugelers, 2007) reported that selection of larger portion sizes was observed for tortilla chips among fifth-grade students. Finally, all participants were familiar and have eaten all the foods; the only exception was Mountain Dew.

Frequency of Reading or Using the Nutrition Facts Label

Regarding the research questions, "How frequently do students read the serving size and amount of calorie information on the Nutrition Facts label" and "How frequently do students use the serving size and amount of calorie information on the Nutrition Facts label when consuming food," this study found that 83.9% of the participants sometimes or always

read serving size information as well as 78.6% of the participants sometimes or always read calorie information on the Nutrition Facts label. Similarly, the majority of students sometimes or always use the serving size information (58%) as well as calorie information (63%) when consuming food. This result showed a similar trend to a previous study. Marieta, Welshimer, and Anderson (1999) found that 70% of students looked at the Nutrition Facts label when purchasing a product for the first time, whereas 43% of students used the label to help them fit the food into their daily diet when consuming food. Another study (Neuhouser, Kristal, & Patterson, 1999) also reported that 44.9% of people usually read serving size information as well as 68.6% of people usually read calorie information. These studies were conducted just after the Nutrition Labeling and Education Act of 1990 that mandated that standardized nutrition information appear on almost all packaged foods manufactured since May 1994. The higher percentage of students from this study, compared with the earlier studies, which read and use the label, might be explained by the time that has elapsed allowing increased familiarity and prevalence of label use among people.

Understanding of Serving Size Information on the Nutrition Facts Label

As for the research question, "Can students correctly identify the serving size of food using the Nutrition Facts label," over 45% of students correctly selected the serving size of most of the food items; whereas only 23% of students correctly identified the serving size of Cheerios. More than 60% correctly identified the serving size of the pizza slice (68.8%), M&M's (60.7%), and orange juice (62.5%). The serving size estimation for these three food items might be more easily identified than other food items because the Nutrition Facts label on the pizza slice showed 1/6 slice of a whole pizza, and for M&M's and orange juice the labels showed half of the package as a serving. The serving size of the other food items

might be difficult because of the research photographs. For example, one serving of Cheerios was 1 cup (28g); however, Cheerios in the photograph was in a bowl; and thus some of the participants would have difficulty translating the serving size information on the food label to the amount pictured in the bowl. Cheerios had the lowest percent of correct answers (23%). A similar finding was observed in macaroni and cheese because one serving size of macaroni and cheese was 1 cup whereas macaroni and cheese in the photograph supplied to the participant for selection of serving size was on a plate.

Ability to Estimate the Calorie Content Using the Nutrition Facts Label

Regarding the research question, "Can students correctly estimate calorie content of food using the Nutrition Facts label," over 65% of students estimated the correct amount of calories from most of the foods; but only 30% of students correctly identified the amount of calories in macaroni and cheese. Over 80% correctly answered the calorie content for orange juice (94.6%), Cheerios (85.7%), pizza slice (83.9%) and M&M's (82.1%). Compared with these food items, the percent correctly answering the calorie content for macaroni and cheese was the lowest. The potential reason was that the participants could misunderstand the information on the label because there were two columns of calorie information on the label, one for calories for uncooked and one for calories for cooked macaroni and cheese. When reviewing the raw data, about 35.7% of the participants utilized the calories of two servings of uncooked macaroni and cheese although the picture shown to the participants was cooked macaroni and cheese.

Association of the Gender Difference with Selected Portion Sizes

Regarding the research question "Does gender difference affect the portion sizes selected," results indicated that there was a significant difference in the self-selected portion

sizes of pizza as well as the portion sizes of Mountain Dew between females and males. Table 10 shows that female participants selected the 1.02 and 1.53 times larger portions of pizza slice than the reference size whereas male participants selected the largest portion, two times larger than the reference size. Similarly, female students selected 1.0 or 1.25 times larger portions of Mountain Dew, whereas male students again selected the largest portion, 2.5 times the reference size. This result agreed with a previous study by Burger, Kern, and Coleman (2007) that indicated that women selected smaller portions of the high-energy, high-fat, and high-carbohydrate foods compared to men (Peanuts, M&M candies, tortilla chips, macaroni and cheese, and Coca-cola).

Association of the BMI with Selected Portion Sizes

In regard to the research question, "Does students' BMI affect the portion sizes selected by students," the result indicated that individuals with higher BMIs selected larger portions of Mountain Dew. Burger, Kern, and Coleman (2007) found a strong relationship between BMI and large portion sizes for high energy-density foods, snacks, and high-carbohydrate foods, such as peanuts, M&M candies, Cheerios, jam, and soda (Coca-Cola). Regarding soda, the result of this present study agreed with the previous study; however, no other relationships between BMI and other high-energy-dense foods, snacks, and high carbohydrate foods were observed. A potential reason would be the smaller sample size. Another reason might be that there were not enough numbers of participants with high or low BMI; resulting in this disparity.

Difference in the Selected Portion Sizes between Hunger and Non-Hunger States

Regarding the research question, "Is there difference in the self-selected portion sizes between the hungry or not-hungry state," data analysis showed that there was no

significant difference in portion sizes between these states. The selected portion sizes were not affected by their degree of hunger. This result agreed with the previous studies (Schwartz & Byrd-Bredbenner, 2006; Rolls, Roe, Meengs, & Wall, 2004).

Difference in the Selected Portion Sizes between Liking and Not-Liking

In regard to the research question, "Is there a difference in the self-selected portion sizes between the liking and dislike for the food items," the results indicated that there were significant differences in the selected portion sizes of all food items between liking and not-liking. Participants' preference for food items resulted in larger self-selected portion sizes for all items. This finding is in contrast to the previous study (Schwartz & Byrd-Bredbenner, 2006) of college students which showed that there were no effects of liking of foods on the selection of portion sizes. The food items utilized in their study included cornflakes, milk on cereal, sugar on cereal, toast, butter, jelly, milk to drink, and orange juice for breakfast, tuna salad, bread, tossed salad, salad dressing, fruit salad, and soda for lunch as well as dinner. This discrepancy might be explained by the difference in the more popular food items for college students provided in the present study.

Association of Frequency of Reading of the Serving Size Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

Regarding the research question, "Does the frequency of reading the serving size information in the Nutrition Facts label affect the self-selected portion sizes," students' frequency of reading of serving size information did not affect the self-selected portion size of any food items, suggesting that although students read food labels frequently, they did not necessarily interpret the information effectively for the selection of portion sizes. Additionally, the age of students might be related to this result because the previous studies

that showed beneficial effects of label use on fat intake or dietary quality had older populations who tend to be more health conscious than younger college students.

Association of Frequency of Reading the Calorie Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

As for the research question, "Does the frequency of reading the calorie information in the Nutrition Facts label affect the self-selected portion sizes," no association between the frequency of reading calorie information and self-selected portion sizes was found. This result was similar to the finding above of the non-association of frequency of reading the serving size information with the self-selected portion sizes, suggesting that individuals did not translate the label information effectively for selection of portion sizes although they reported frequently reading the calorie information on the label.

Association of Frequency of Use of the Serving Size Information on the Nutrition Facts Label when Consuming Food with the Self-Selected Portion Sizes

Regarding the research question, "Does the frequency of use of the serving size information in the Nutrition Facts label to fit food into their daily diet when consuming food affect the self-selected portion sizes," data analysis indicated that there were significant negative correlations between the frequency of use of serving size information to fit food into their diet and selected portion sizes of tortilla chips as well as M&M's. This finding suggests that individuals who frequently use the serving size information with health consciousness selected smaller portions of snacks. This finding was consistent with a previous study be Schnoll and Zimmerman (2001) that indicated that dietary change requires self-regulation of food intake. The potential reason that there was no correlation between the frequency of use label with portion sizes of other foods would be that people

may consider the portions of high-calorie and high fat snacks more than the portions of main dishes or drinks. This finding was the same as the recommended practice by the CDC and the Dietary Guidelines for Americans. Self-regulation of food intake using serving size information on the label could help people control their portion sizes, but the guideline needs to be translated into selection of portions for main dishes and beverages.

Association of Frequency of Use of the Calorie Information on the Nutrition Facts Label when Consuming Food with the Self-Selected Portion Sizes

In regard to the research question, "Does the frequency of use of calorie information in the Nutrition Facts label to fit food their daily diet when consuming food affect the self-selected portion sizes," no significant correlation between frequency of use of calorie information to fit food into their daily diet and the self-selected portion size was found. This result did not parallel the finding of the negative association of the frequency of use of the serving size information with the self-selected portion sizes of snacks. One of the reasons for this discrepancy might be the difference between processing information. When individuals consider only calories, they only see the calorie information and might not see the serving size of the food. This finding indicated that individuals did not translate the calorie information effectively to their selection of portion sizes although they frequently used the calorie information with health consciousness.

Association of Understanding the Serving Size Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

As for the research question, "Does the understanding of serving size information affect the self-selected portion sizes," this study found significant positive correlations between the understanding of serving size and selected portion sizes of only macaroni and

cheese and Cheerios. The potential reason for this finding would be that the relationship between nutrition knowledge and actual behavior change is not strong. A study by Kral, Roe, and Rolls (2002) investigated whether the provision of information about the energy density of food affects food intake in normal-weight women. They found the pattern of food intake was not affected by the nutrition information provided. This finding indicated that individuals did not translate the serving information of food appropriately for selection of portion sizes although they could correctly identify the serving size with the food label.

Association of Ability to Estimate Calorie Content Using the Information on the Nutrition Facts Label with the Self-Selected Portion Sizes

Regarding the research question, "Does the understanding of calorie information affect the self-selected portion sizes," only two significant positive correlations between the ability to estimate calorie content and selected portion sizes of pizza and macaroni and cheese were found. This finding was similar to the finding above of limited number of positive associations of understanding of serving size information with the self-selected portion sizes. From these findings, participants' understanding of serving size and calorie information were not appropriately translated into selection of portion sizes of food.

Limitations

The two main limitations of the study include the limited number of food items examined and the limited number of different portion sizes. The number of food items tested in this study was limited due to the limited period of time to allow students to complete the survey although most of the participants reported that they liked those food items as well as generally consumed them. The second limitation was the limited number of different portion sizes for the food photographs due to the difficulty to express the portion size differences as

a photograph although the findings regarding comparisons of the self-selected portion sizes with the reference sizes were consistent with the previous findings of other studies. Another limitation was a small sample size. The size of the sample size was relatively small to conduct conclusive statistical analysis due to a limited period of data collection, although findings that resulted from analysis were generally consistent with previous findings when relating to comparisons of self-selected portion sizes with the reference sizes as well as the food label use. Due to the small sample size, the overweight and obesity rate may also have been misrepresented in this study as well.

Conclusions

Similar to the previous studies, approximately 40% or more students selected larger portion sizes compared to the reference sizes. This finding indicated that nutritional educators should raise awareness of portion distortion and instruct the appropriate portion size when educating college students. Also, although students used the information on the food labels frequently as well as understood the serving size and calorie information correctly, they did not effectively interpret the information for the selection of portion sizes. However, frequent use of the serving size information with health consciousness helped students select smaller portion sizes of some snacks. This finding suggested that students need the nutrition education not only for how to use the food label, but also how students should translate the information from food label into their selection of food portions appropriately.

Recommendations

Recommendations for continued research in association of self-selected portion sizes with the food label could include more variety of food items, increase in the number of

different portion sizes of food, and increase the sample size. Use of a variety of food items would help researchers to more fully examine typical portion sizes students generally consumed as well as examining of their understanding of serving size and calorie information more accurately. Similarly, having more different portions in the study helps researchers collect accurate portion size information. Finally, increasing sample size helps researchers to examine the association of BMI with selected portion sizes through having more representative data about collage students' BMI.

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Appendix A: UW-Stout Institutional Board Approval of Research

STOUT
UNIVERSITY OF WISCONSIN

Research Services
152 Voc Rehab Building

University of Wisconsin-Stout
P.O. Box 790
Menomonie, WI 54751-0790

715/232-1126
715/232-1749 (fax)
http://www.uwstout.edu/rs/

Date: July 22, 2008

To: **Tomoko Tanaka**

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

Subject: **Protection of Human Subjects**

Your project, "**Association of food label use with portion sizes selected by students at University of Wisconsin-Stout**," has been approved by the IRB through the expedited review process. The measures you have taken to protect human subjects are adequate to protect everyone involved, including subjects and researchers.

Please copy and paste the following message to the top of your survey form before dissemination:

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

This project is approved through February 19, 2009. Modifications to this approved protocol need to be approved by the IRB. Research not completed by this date must be submitted again outlining changes, expansions, etc. Federal guidelines require annual review and approval by the IRB.

Thank you for your cooperation with the IRB and best wishes with your project.

***NOTE: This is the only notice you will receive – no paper copy will be sent.**

Appendix B: Survey Form

Portion Sizes and Nutrition Fact Label Survey

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

Your completion of this survey indicates that you have read the informed consent form and have agreed to participate in this study. You may stop participating in this study at anytime. Please answer the following items to the best of your ability. Please **do not** place your name or any personal identification on this survey. When the survey is completed, please hand the survey and pictures back to the researcher.

Gender: ____ male ____ female

Age: ____years old – **If you are younger than 18, please stop here!**

Major: _____
If you are majoring in Food Science, Nutrition, or Dietetics, please stop here.

Status: ____ Freshman ____Sophomore ____Junior ____Senior ____Graduate

Race: ____Caucasian ____ Native American ____ African America ___ Asian American
____ Hispanic ____ Other, please specify:_____

Weight: ____ #
Height: ____ inches

How do you feel hungry at this moment? ____very hungry ____hungry ____somewhat hungry ____not hungry

<u>Food Item #1 (Pizza Slice)</u> * If you haven't eaten this item, please, skip this section

1. How much do you like or dislike this food item?
   ____ dislike ____ not very much ___somewhat like ____ like

2. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
   ____ A ____ B ____ C ____ D

<u>Food Item #2 (Macaroni & Cheese)</u> *If you haven't eaten this item, please, skip this section

3. How much do you like or dislike this food item?
   ____ dislike ____ not very much ___somewhat like ____ like

4. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
   ____ A ____ B ____ C ____ D

Food Item #3 (Tortilla Chips) * If you haven't eaten this item, please, skip this section

5. How much do you like or dislike this food item?
   ____ dislike ____ not very much ___somewhat like ____ like

6. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
   ____ A ____ B ____ C ____ D

Food Item #4 (Soda) * If you haven't eaten this item, please, skip this section

7. How much do you like or dislike this food item?
   ____ dislike ____ not very much ___somewhat like ____ like

8. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
   ____ A ____ B ____ C ____ D

Food Item #5 (M&M's) * If you haven't eaten this item, please, skip this section

9. How much do you like or dislike this food item?
   ____ dislike ____ not very much ___somewhat like ____ like

10. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
    ____ A ____ B ____ C ____ D

Food Item #6 (Cheerios: Before pouring milk) * If you haven't eaten this item, please, skip this section

11. How much do you like or dislike this food item?
    ____ dislike ____ not very much ___somewhat like ____ like

12. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
    ____ A ____ B ____ C ____ D

Food Item #7 (Orange Juice) * If you haven't eaten this item, please, skip this section

13. How much do you like or dislike this food item?
    ____ dislike ____ not very much ___somewhat like ____ like

14. Please identify the portion size of this food item that you usually consume, and check the letter (A-B-C-D) from the pictures which represents that size.
    ____ A ____ B ____ C ____ D

Nutrition Facts

1. How often do you **READ the serving size information** of food on the Nutrition Facts label?
   ____ never ____ sometimes ____ always

2. How often do you **READ the amount of calories** in a food on the Nutrition Facts label?
   ____ never ____ sometimes ____ always

3. When you eat a food item, do you **USE the serving size information** on the Nutrition Facts label to help you fit that food into your daily diet?
   ____ never ____ sometimes ____ always

4. When you eat a food item, do you **USE the calorie information** on the Nutrition Facts label to help you fit that food into your daily diet?
   ____ never ____ sometimes ____ always

Please answer the following questions after reading the information on the Nutrition Facts label on each food item.

Food Item #1 (Pizza Slice)

1. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

2. How many calories would you consume if you ate **two slices of pizza**? _____ calories

Food Item #2 (Macaroni & Cheese)

3. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

4. How many calories would you consume if you ate **two cups**? _____ calories

Food Item #3 (Tortilla Chips)

5. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

6. How many calories would you consume if you ate **a whole bag**? _____ calories

Food Item #4 (Soda)

7. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

8. How many calories would you consume if you drank **a whole bottle**? _____ calories

Food Item #5 (M&M's)

9. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

10. How many calories would you consume if you ate **a whole bag**? _____ calories

Food Item #6 (Cheerios) * before pouring milk

11. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

12. How many calories would you consume if you ate **two cups**? _____ calories

Food Item #7 (Orange Juice)

13. Please identify the portion of this food item that is indicated on the Nutrition Facts label as **a serving** and check the letter from the picture which represents that size:
   ____ A ____ B ____ C ____ D

14. How many calories would you consume if you drank **a whole bottle**? _____ calories

Thank you very much for your participation!

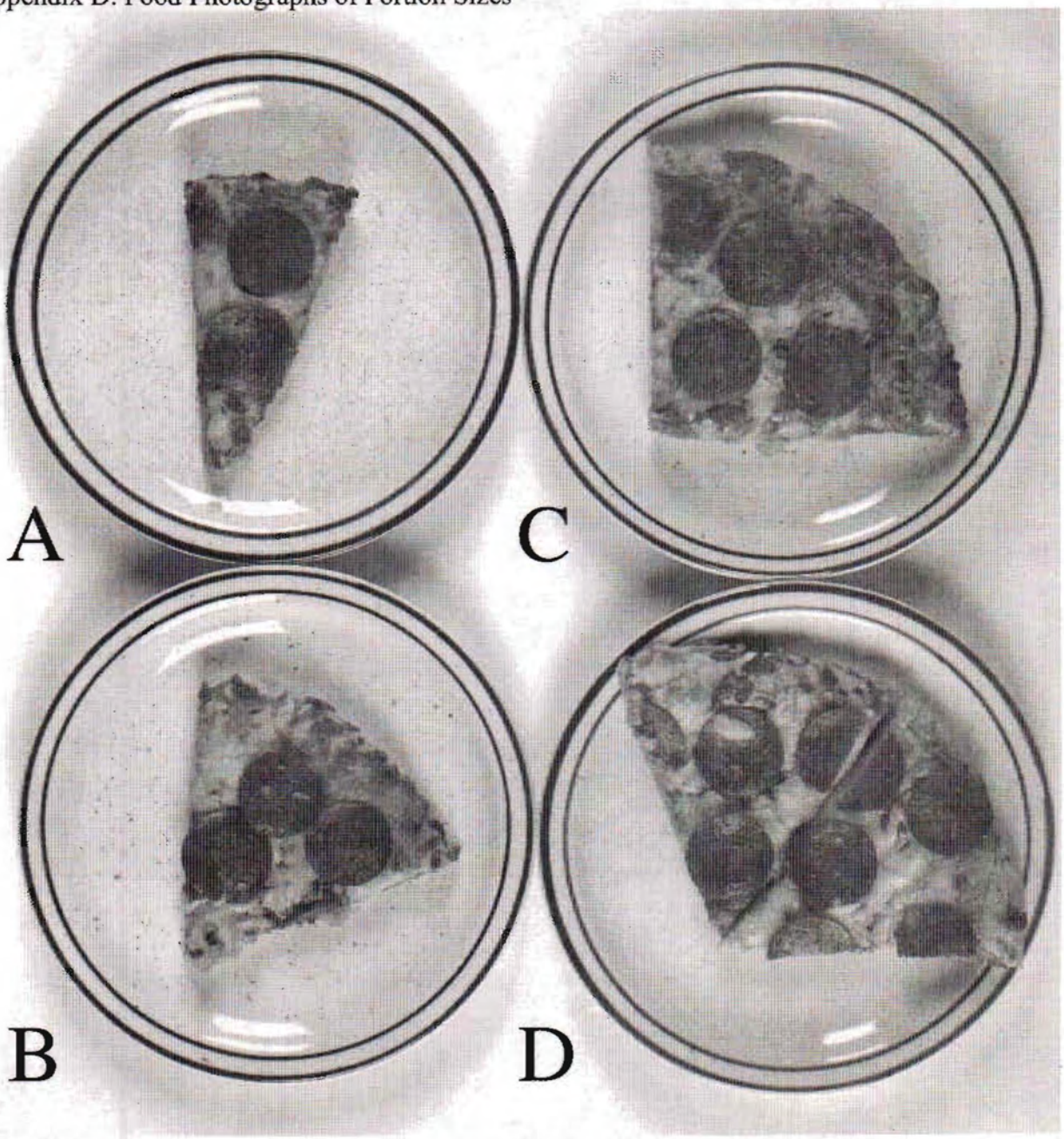
Appendix C: Consent Form

Portion Sizes and Nutrition Facts Label Survey

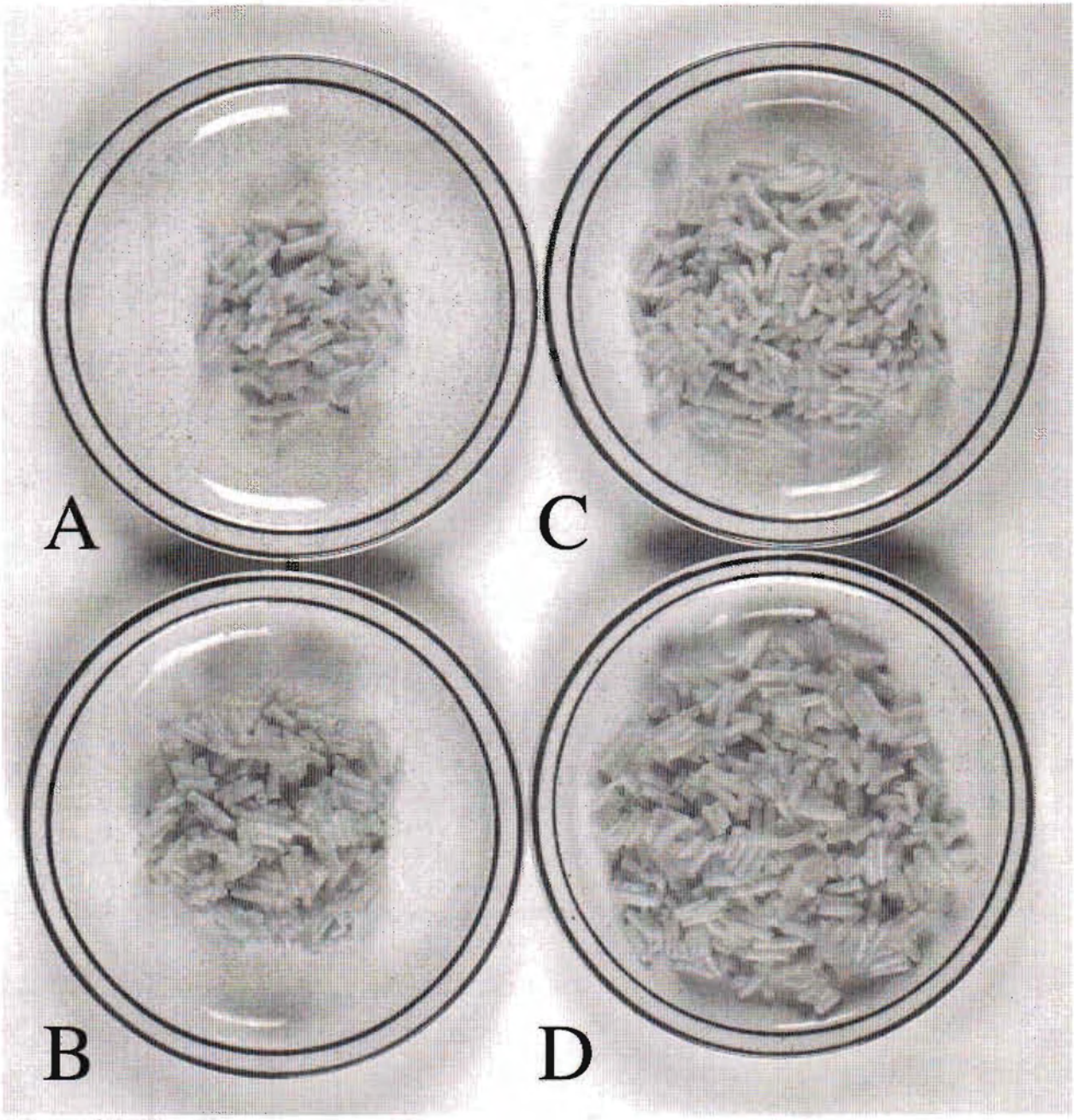
Tomoko Tanaka, a graduate student at (715) 235-4814 in Food and Nutritional Sciences, is conducting a survey titled, portion sizes and Nutrition Facts label survey. Her faculty advisor is Dr. Carol Seaborn at (715) 232-2216 or 219 Home Economics Building.
The purpose of this study is to investigate the portion sizes of foods selected by students and the use and understanding of Nutrition Facts label among students at the University of Wisconsin-Stout. As a volunteer, you will be asked to take a brief 32 question survey regarding portion sizes of food items, liking for each food items, the frequency of use of the Nutrition Facts label, estimating a serving size of food item and the calorie content using food photographs and Nutrition Facts labels. You will also be asked to provide your gender, age, major, status, race and your hunger state. Additionally, your weight and height will be measured by the researcher. This is conducted behind a cardboard screen. This survey will take approximately 10-15 minutes to complete. This study investigates the portion sizes of foods and the use and knowledge of Nutrition Facts label among college students.
It is not anticipated that this study will present any medical or social risk to you. You are not being compared to other students on any skills or ability.
The study's compiled data will benefit health professionals in developing educational materials for college students. The information gathered will be kept strictly confidential and any reports of the findings of this research will not contain any identifying information. Also, the researcher will never publish or share any information that could identify a person from my survey.

Your participation in this project is completely voluntary. You may choose not to participate without any adverse consequence to you. If at any time you wish to stop participating in this research, you may do so without coercion or prejudice. Just inform the researcher. However, should you decide to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been turned into the researcher.
Your participation in this survey would be greatly appreciated.
If you have questions about the survey, please contact Tomoko Tanaka (tanakat@uwstout.edu). Questions or concerns about participation in this survey or complaints about this study should be directed to Dr. Carol Seaborn at (715) 232-2216 or seabornc@uwstout.edu or 219 Home Economics Building. Questions concerning your right as a human subject should be directed to Ms. Sue Foxwell (Director of Research Services) 713-232-2477 or foxwell@uwstout.edu, UW-Stout, Menomonie, WI.

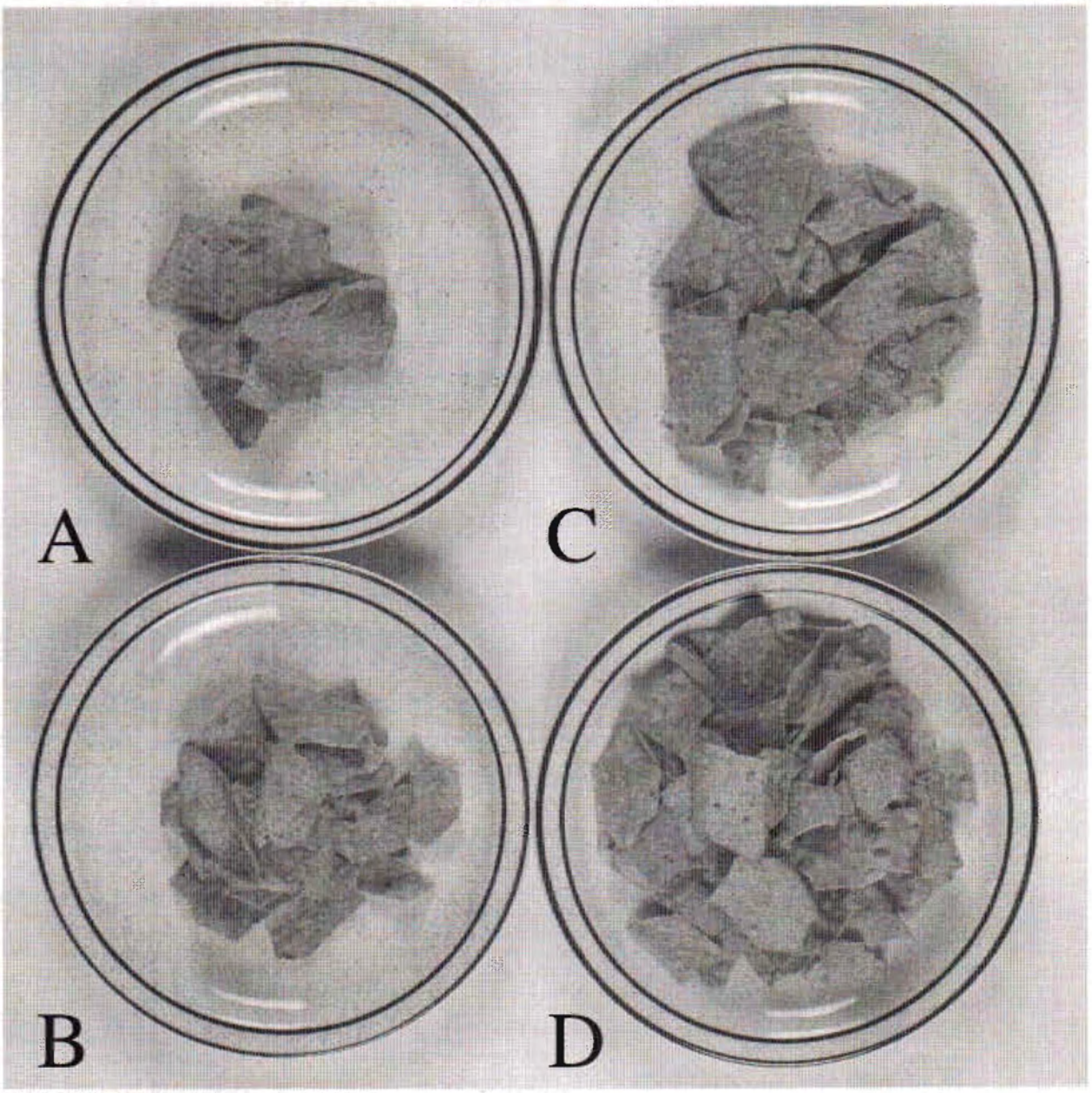
Appendix D. Food Photographs of Portion Sizes



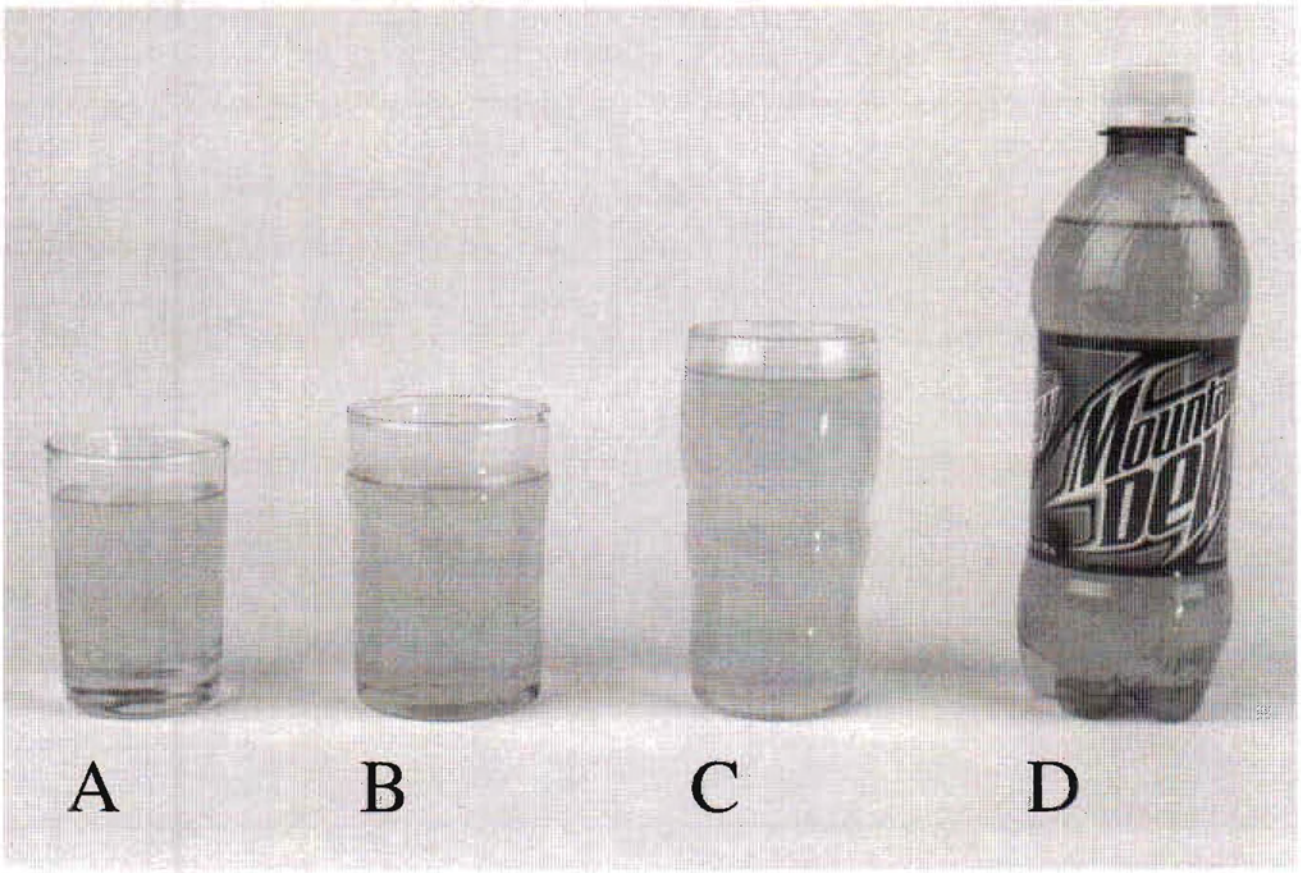
Pizza slice



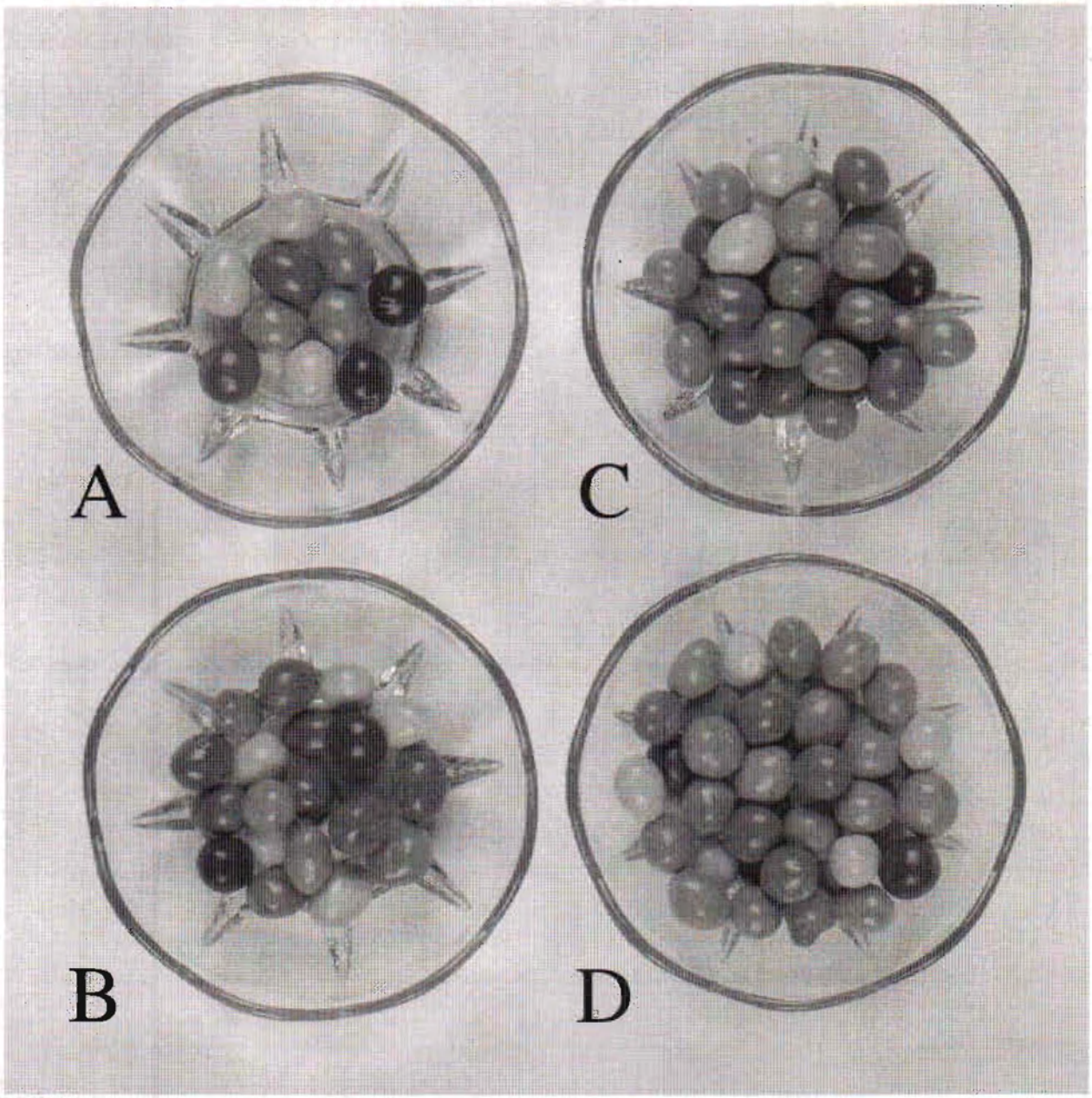
Macaroni & Cheese



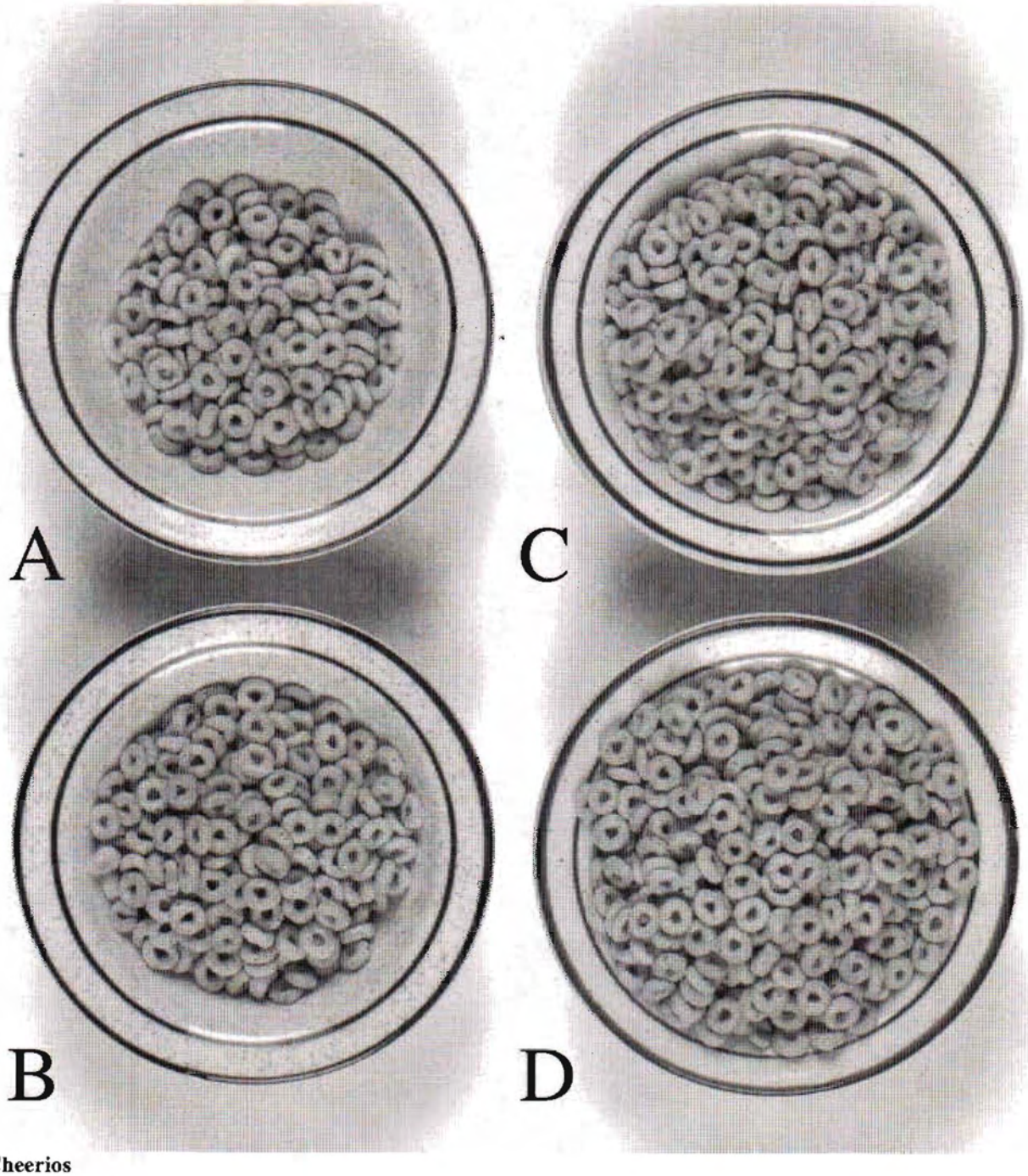
Tortilla chips



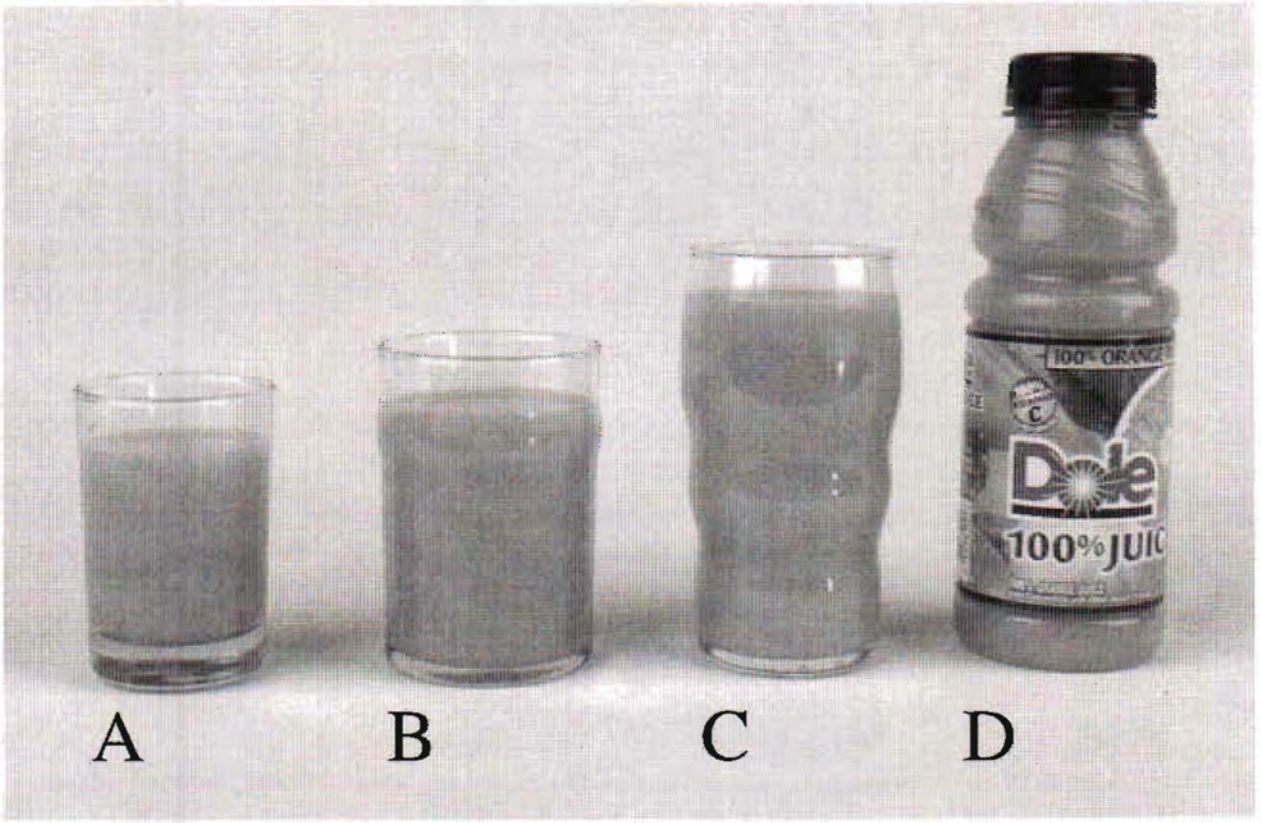
Mountain Dew



M&M's



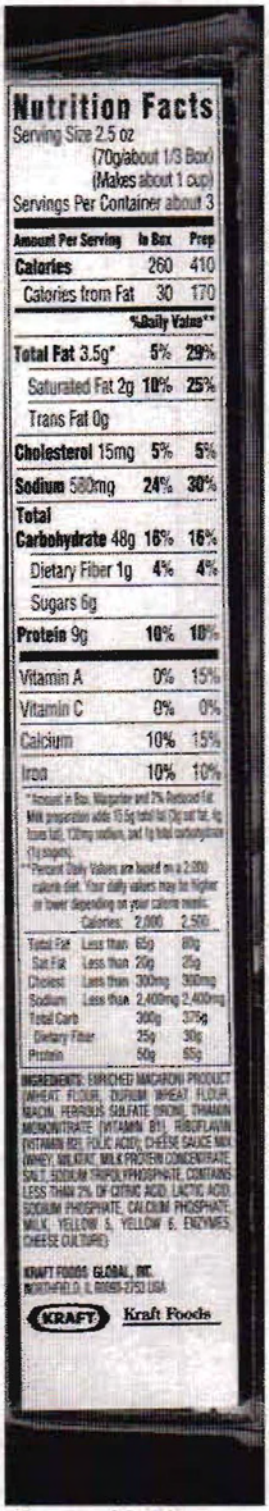
Cheerios



Orange juice

Appendix E: Nutrition Facts Label

Pizza slice



Nutrition Facts

Serving Size 2.5 oz
(70g/about 1/3 Box)
(Makes about 1 cup)
Servings Per Container about 3

Amount Per Serving	In Box	Prep
Calories	260	410
Calories from Fat	30	170
	%Daily Values**	
Total Fat 3.5g*	5%	29%
Saturated Fat 2g	10%	25%
Trans Fat 0g		
Cholesterol 15mg	5%	5%
Sodium 580mg	24%	30%
Total Carbohydrate 48g	16%	16%
Dietary Fiber 1g	4%	4%
Sugars 6g		
Protein 9g	18%	18%
Vitamin A	0%	15%
Vitamin C	0%	0%
Calcium	10%	15%
Iron	10%	10%

*Amount in Box. Margarine and 2% Reduced Fat Milk preparation adds 15.5g total fat (3g sat fat, 4g trans fat), 120mg sodium, and 1g total carbohydrate (1g sugars).

**Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholest	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carb		300g	375g
Dietary Fiber		25g	30g
Protein		50g	65g

INGREDIENTS: ENRICHED MACARONI PRODUCT (WHEAT FLOUR, DURUM WHEAT FLOUR, NIACIN, FERROUS SULFATE (IRON), THIAMIN MONONITRATE (VITAMIN B1), RIBOFLAVIN (VITAMIN B2), FOLIC ACID); CHEESE SAUCE MIX (WHEY, MILKFAT, MILK PROTEIN CONCENTRATE, SALT, SODIUM TRIPOLYPHOSPHATE, CONTAINS LESS THAN 2% OF CITRIC ACID, LACTIC ACID, SODIUM PHOSPHATE, CALCIUM PHOSPHATE, MILK, YELLOW 5, YELLOW 6, ENZYMES, CHEESE CULTURE).

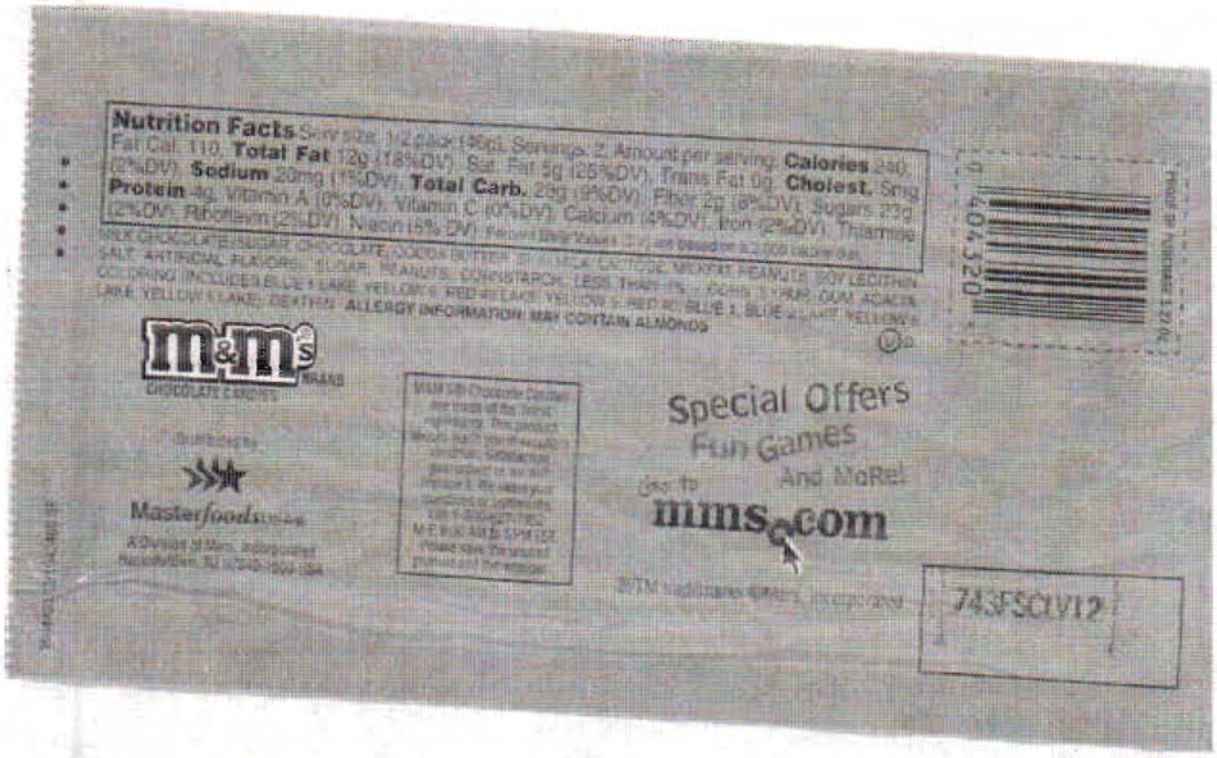
KRAFT FOODS GLOBAL, INC.
NORTHFIELD, IL 60093-2753 USA

KRAFT Kraft Foods

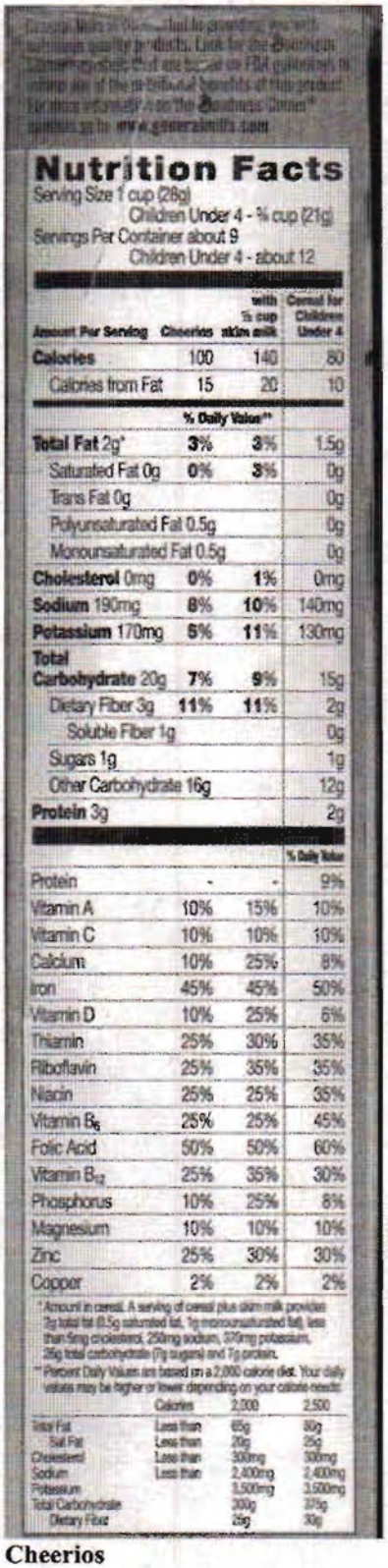
Macaroni& Cheese

Tortilla chips

Mountain Dew


Nutrition Facts
m&m's
Special Offers
Fun Games
And More!
mms.com

M&M's



Nutrition Facts

Serving Size 1 cup (28g)
Children Under 4 - ¾ cup (21g)
Servings Per Container about 9
Children Under 4 - about 12

Amount Per Serving	Cheerios	with ½ cup skim milk	Cereal for Children Under 4
Calories	100	140	80
Calories from Fat	15	20	10
	% Daily Value**		
Total Fat 2g*	3%	3%	1.5g
Saturated Fat 0g	0%	3%	0g
Trans Fat 0g			0g
Polyunsaturated Fat 0.5g			0g
Monounsaturated Fat 0.5g			0g
Cholesterol 0mg	0%	1%	0mg
Sodium 190mg	8%	10%	140mg
Potassium 170mg	5%	11%	130mg
Total Carbohydrate 20g	7%	9%	15g
Dietary Fiber 3g	11%	11%	2g
Soluble Fiber 1g			0g
Sugars 1g			1g
Other Carbohydrate 16g			12g
Protein 3g			2g
			% Daily Value
Protein	-	-	9%
Vitamin A	10%	15%	10%
Vitamin C	10%	10%	10%
Calcium	10%	25%	8%
Iron	45%	45%	50%
Vitamin D	10%	25%	6%
Thiamin	25%	30%	35%
Riboflavin	25%	35%	35%
Niacin	25%	25%	35%
Vitamin B_6	25%	25%	45%
Folic Acid	50%	50%	60%
Vitamin B_{12}	25%	35%	30%
Phosphorus	10%	25%	8%
Magnesium	10%	10%	10%
Zinc	25%	30%	30%
Copper	2%	2%	2%

* Amount in cereal. A serving of cereal plus skim milk provides 2g total fat (0.5g saturated fat, 1g monounsaturated fat), less than 5mg cholesterol, 250mg sodium, 370mg potassium, 35g total carbohydrate (7g sugars) and 7g protein.

** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Potassium		3,500mg	3,500mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Cheerios

Orange juice