College Students' Knowledge of Cereal Serving Sizes

by

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ABSTRACT

This study attempts to determine the serving size knowledge of students attending the University of Wisconsin-Stout during the fall of 2005 by measuring a student’s ability to identify recommended serving sizes and compare their perception of a recommended serving size with the amount that they report to consume at a single sitting.

It was determined that students report eating significantly more cereal at one sitting than they believe to be a serving size. Students were able to recognize the amount of cereal that constitutes one serving and reported eating more than a serving size at one sitting despite their knowledge. Students are aware they are overeating.

Men, in general, reported eating more than women, despite age and the number of times per week that cereal is eaten. When all demographic variables were combined in analysis, no demographic significantly explained the differences in amount of cereal eaten. All demographic groups were able to recognize a serving size of cereal, regardless of age, gender, and the number of times per week cereal is consumed.
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Chapter I: Introduction

Portion sizes and the number of obese and overweight citizens in the United States (U.S.) have both been increasing since the 1970's. These parallel trends indicate there is a relationship between the two. In addition to environmental factors such as package size, variety of foods offered, and plate shape (Wansink, 2004), production, marketing, and government policies all encourage excessive energy consumption (Nestle, 2003). According to Nestle (2003), larger portion sizes are perceived as bargains to the consumer, as well as manufacturers and distributors. The corporate farming policies supported by the government mean that the cost for producing the food is miniscule as compared to the costs of packaging, advertising and labor. The practice of “super-sizing” or increasing portion size accounts for a small increase in cost to the manufacturer. Many studies have shown that people tend to eat larger portions of food when confronted with large amounts of food (Bryant & Dundes, 2005; Wansink, 2004; Wansink & Cheney, 2005) and larger portions have more calories. Consumers do not seem to know what constitutes a serving size, making them unable to monitor whether they are over consuming.

According the United States Food and Drug Administration (FDA) the prevalence of obesity in the United States has doubled in the past two decades. The United States Department of Health and Human Services, in Dietary Guidelines for Americans, 2005, included this statement:

Poor diet and physical inactivity, resulting in an energy imbalance (more calories consumed than expended), are the most important factors contributing to the increase in overweight and obesity in this country... In 1999-2002, 65 percent of United States adults were overweight, an increase from 56 percent in 1988-1994. Data from 1999-2002 also showed that 30 percent of adults were obese, an increase from 23 percent in an
earlier survey. Dramatic increases in the prevalence of overweight have occurred in children and adolescents of both sexes, with approximately 16 percent of children and adolescents aged 6 to 19 years considered to be overweight. In order to reverse this trend, many Americans need to consume fewer calories, be more active, and make wiser choices within and among food groups. (p.2)

Overweight and obesity are caused by an energy imbalance that persists over a long period of time. Weight gain is the result of extra calorie consumption and decreased calorie use (Centers for Disease Control, 2005). The cause of the energy imbalance for each individual is complex; genetics and environmental factors may increase a person's risk of gaining weight, but individual behaviors such as food choices and physical inactivity increase the risk for gaining weight (Centers for Disease Control, 2005).

The typical American eating and activity pattern is to consume diets in excess of energy requirements. To maintain a healthy body weight, calories from food and beverages must be balanced with calories expended. To prevent weight gain over time small decreases must be made in food and beverage calories and increases must be made in physical activity (United States Department of Health and Human Services and United States Department of Agriculture, 2005).

Contributing to the problem of energy imbalance is the trend of increased portion size. People have increased the number of calories they consume by eating more during meals and snacks because of larger portion sizes (Centers for Disease Control, 2005).

Special attention should be given to portion sizes, which have increased significantly over the past two decades. Though there are no empirical studies to show a causal relationship between increased portion sizes and obesity, there are studies showing that controlling portion sizes helps limit calorie intake ... Therefore, it is essential that the public understand how portion sizes compare to a recommended amount of food (i.e., serving) from each food group at a specific caloric level... When using packaged foods with nutrient labels, people should pay attention to the units for serving sizes and how they compare to the serving sizes in the USDA Food Guide... (p.15)

The Federal Food, Drug, and Cosmetic Act, as amended by the Nutrition Labeling and Education Act of 1990, established mandatory nutrition labeling for packaged foods to enable consumers to make informed and healthy food product choices (United States Department of Health and Human Services, 2005). The act states:

Serving size must be based on the established reference amount...

...b. Serving size is expressed in common household measure (i.e., cup; tablespoon, teaspoon; piece, slice, fraction (e.g., 1/4 pizza); ounce, fluid ounce) and followed by the equivalent metric quantity in parenthesis. When ounces are used a visual unit must be provided after the metric equivalent (e.g. 1 oz (28g/1" X 1" CUBE) The metric quantity is not required for single serving containers unless nutrition information is required on a drained weight basis.

c. A package that is sold individually and contains less that 200% of the applicable reference amount is considered to be one serving. However, for products that have reference amounts of 100 g (or ml) or larger, manufacturers may decide whether a
package that contains more than 150% but less than 200% of the reference amount is one or two servings. When a product contains 200% or more of the reference amount, the manufacturer may label the product as a single serving if the entire package can reasonably be consumed at one sitting. (p.5).

The FDA is in the process of revamping serving size information, in an attempt to aid consumers in deciding how much of a food they should eat. The FDA Obesity Working Group (OWG) has reported that using the food label to promote consumption of smaller portions may be an idea of merit (United States Food and Drug Administration, 2004).

Current research states that only 35% of people in the US use the nutrition label “often” to figure out how much to eat (United States Food and Drug Administration, 2004). So how is everyone deciding how much to eat? Are they just guessing? If someone does read the label, do they know how much the recommended serving size is without measuring? This research will contribute to the body of knowledge that is being developed to combat the epidemic of obesity and overweight. This research will be a careful, systematic investigation and compilation of students' knowledge of portion size, a key element in weight control.

Statement of the Problem

The purpose of this study is to determine the serving size knowledge of students attending the University of Wisconsin-Stout during the fall of 2005. This study will measure the student’s ability to identify recommended serving sizes and compare their perception of a recommended serving size with the amount that they report to consume at single sitting. Data will be collected in the Memorial Student Center. Students will be asked to pour the amount of cereal they would normally eat in one sitting into a bowl. Students will then be asked to read the nutrition information on the side of the box and then pour their estimation of a standard serving
size of the cereal into a second bowl. The bowls will then be weighed to measure the amount the student believed was a serving. Each student will contribute to both the control group and the experimental group. The control group will be the bowls that contain the amount of cereal they would normally eat at one sitting. The experimental group will be the bowls that contain what they believe to be a recommended serving after reading the nutrition label.

Bowls and boxes of cereal will be provided. A simple registration form will be given to each student and they will be asked to record their gender, major, age, and frequency of cereal consumption.

Study Objectives

Studies suggest that consumers do not regularly use the Nutrition Facts Label printed on food packages when they determine the amount of food they will eat at one sitting (United States Food and Drug Administration, 2004; United States Department of Health and Human Services, 1999; Young & Nestle, 2002). Specifically the purpose of this study is to assess the weight in grams of ready-to-eat cereal that University of Wisconsin-Stout students identify as a portion to be consumed at a single sitting and the weight in grams of the amount of ready-to-eat cereal that the students believe to be a recommended serving after reading the Nutrition Facts Label. The objectives of the study are:

1. Determine the size of the portion of cereal that students say they eat at one sitting.
2. Determine the size of the portion of cereal that students believe to be a recommended serving size after reading the package Nutrition Facts Label.
3. Analyze this data to determine if there are significant differences between the two portions.
4. Analyze this data to determine if there are differences in the portions between different demographic groups.

**Hypothesis**

*Primary Null Hypothesis:* There will be no significant difference between the amount of cereal students identify as a portion to be consumed at one sitting and the recommended serving size.

**Definition of Terms**

The following terms need to be defined for reasons of clarity:

*Nutrition Facts Label:* Required for most foods, the Nutrition Facts Label can be found on the packaging of purchased food products. The FDA regulates the Nutrition Facts Label according to the provisions of the Nutrition Labeling and Education Act of 1990 (NLEA), which, among other things, authorizes the use of nutrient content claims and appropriate FDA-approved health claims. Printed in a distinctive, easy-to-read format they are designed to enable consumers to more quickly find the information they need to make healthful food choices. Standardized serving sizes make nutritional comparisons of similar products easier.

*Portion Size:* The amount of food actually eaten at one sitting, regardless of recommended serving size.

*Recommended Serving Size:* The amount of food customarily eaten at one time. The serving sizes that appear on food labels are based on FDA-established lists of "Reference Amounts Customarily Consumed per Eating Occasion." They must be expressed in both common household and metric measures.
Assumptions and Limitations

It is assumed that subjects will be giving truthful information about the amount of cereal that they eat at one sitting. It is also assumed that the subjects will measure out what they believe to a recommended serving size of cereal and not modify the amount in an attempt to please the researcher. Subjects may feel uncomfortable revealing information about the amount that they eat at a single sitting. There is a possibility of emotional discomfort attached to revealing this information.

One limitation of this study is that, because subjects were not asked their body mass index, there will be no ability to correlate portion size with body size. The subjects were not asked their body mass index because it would decrease their willingness to participate in this study.

Another limitation of this study is that there is a very limited measure of external validity, due to the fact that there are very few published studies of this type. Conclusions drawn from the data must be very carefully analyzed to determine if there is internal validity.
Chapter II: Literature Review

Introduction

This chapter will discuss obesity trends, recommended serving sizes, portion size trends, and studies about food consumption patterns.

Obesity Trends

As stated in the introduction, the prevalence of obesity and overweight in the United States has risen dramatically over the last two decades. According to the Dietary Guidelines for Americans 2005 (United States Department of Health and Human Services and United States Department of Agriculture, 2005):

Poor diet and physical inactivity, resulting in an energy imbalance (more calories consumed than expended), are the most important factors contributing to the increase in overweight and obesity in this country... In 1999-2002, 65 percent of United States adults were overweight, an increase from 56 percent in 1988-1994. Data from 1999-2002 also showed that 30 percent of adults were obese, an increase from 23 percent in an earlier survey. Dramatic increases in the prevalence of overweight have occurred in children and adolescents of both sexes, with approximately 16 percent of children and adolescents aged 6 to 19 years considered to be overweight. In order to reverse this trend, many Americans need to consume fewer calories, be more active, and make wiser choices within and among food groups. (United States Department of Health and Human Services and United States Department of Agriculture, 2005, p.2)

This is of great public health concern because obesity raises the risk of many diseases, including type 2 diabetes, hypertension, cardiovascular disease, stroke, gall bladder disease, respiratory dysfunction, gout, certain kinds of cancers, and may cause premature death. Many
adults gain weight slowly over time, meaning that decreases in calorie consumption can help avoid weight gain. To decrease calorie consumption, special attention should to given to portion sizes. Portion sizes have been increasing since the 1970s, along with obesity rates. There are no empirical studies that show a causal relationship between increased portion sizes and increased obesity, but there are studies that show controlling portion size helps limit calorie intake (Rolls, 2003; Rolls, Morris, & Roe, 2002; Seligson, 2003; Young & Nestle, 2002). This makes it essential that the public understand how portion sizes compare to the recommended serving size.

*My Pyramid*

The United States Food and Drug Administration (USDA) has distributed food guidance information since 1916, reflecting the health and nutrition concerns of the times (United States Department of Agriculture, 2005). In 1992, the USDA introduced the Food Guide Pyramid (Figure 1) designed to be a general guide for making healthy food choices on a daily basis. The Food Guide Pyramid called for eating a variety of foods to ensure proper nutrition and the proper amount of calories to ensure a healthy weight (United States Department of Health and Human Services, 2000).
In 2005 the USDA released “MyPyramid,” an update to the original Food Guide Pyramid. The new pyramid was created to reflect new standards for nutrient intakes, new data on food consumption patterns, and new data on food composition (United States Department of Agriculture, 2005). Additionally, MyPyramid is designed to allow consumers to use the recommendations in a more effective manner, through the incorporation of motivational and educational tools (Britten, Haven, & Davis, 2006). MyPyramid, available at mypyramid.gov, offers consumers the opportunity to create personalized eating plans, through the use of interactive tools. Consumers answer questions about their height, weight, gender, and activity levels and are then presented with one of twelve food intake patterns. Print materials, providing general information for all consumers, were also developed.
The USDA developed My Pyramid in two separate research stages. The first stage, the development of food intake patterns, involved using technical analysis to establish the food intake patterns of Americans (what and how much they should and do eat) (United States Department of Agriculture, 2005). The second stage of research was the development of consumer presentations and materials that communicated the information discovered in the first stage.
The USDA conducted consumer research in order to identify consumer understanding of nutrition messages, as well as to identify which messages consumers found confusing (Britten, et al, 2006). The USDA research findings included the following:

- Consumers had a general understanding of what healthy eating meant, but had trouble practicing healthy eating.
- Consumers understood the general messages of the original food pyramid, but thought the pyramid was complicated. They had difficulty identifying detailed information from the graphic.
- Some food groups and concepts were difficult for consumers to understand.
- Consumers did not use the word “serving” in the same way as nutrition professionals. Consumers considered a serving to be the portion on their plate, while nutrition professionals considered a serving to be a standardized amount of food. (Britten, et al, 2006).

Of special interest to this study is the research finding regarding the use of the term “serving.” Consumers use the term “serving” to mean the portion of food on their plate. Describing a recommended amount of food to a consumer as a certain “number of servings,” translates to a consumer that they should eat the food that many times, even if their typical portion is much larger than the standardized “serving” professionals envision (United States Department of Agriculture, 2005).

In order to address this discrepancy, the USDA eliminated the use of the term “servings” when describing the recommended amounts of food on MyPyramid. MyPyramid describes recommended amounts of a food in cups or ounces per day, which can be eaten as several portions at different times. The USDA research found that cups or ounces were well understood
by consumers as long as examples were provided for each food group (United States Department of Agriculture, 2005). The MyPyramid website provides examples of how much food should be considered a cup or ounce equivalent in every food group, including graphics of what that amount looks like to a consumer (United States Department of Agriculture, 2005).

Recommended Serving Sizes

The USDA monitors the food nutrition labels found on packaged foods. The serving size, as listed on packaged foods, is the basis for reporting each food's nutrient content and is not necessarily the same amount as a recommended serving. In the past, the food manufacturer created the serving size and used that amount to determine the information on the nutrition facts label. Serving sizes now are more uniform and reflect the amounts people actually eat. The serving size must be expressed in both common household and metric measures. Common household measures could be the cup, tablespoon, teaspoon, piece, slice, or fraction (such as "1/4 pizza"). Ounces may be used, but only if a common household unit is not applicable. The metric units used on the food nutrition label are grams (g) and milliliters (mL). The Nutrition Labeling and Education Act of 1990 (NLEA) defines serving size as the amount of food customarily eaten at one time. The serving sizes that appear on food labels are based on FDA-established lists of "Reference Amounts Customarily Consumed per Eating Occasion." If food products that are packaged and sold individually contain less than 200 percent of the applicable reference amount, the item qualifies as one serving (United States Department of Health and Human Services, 1999). For example, a large muffin may contain 150% of the FDA established reference amount for a muffin, but because a muffin is generally eaten all at one sitting, it can be labeled as one serving.
In the article Knowledge, Attitudes, and Behaviors of College Students Regarding the 1990 Nutrition Labeling Education Act Food Labels (Marietta, Welshimer, & Long Anderson, 1999) 208 college students were surveyed to ascertain what they knew about food nutrition labels and how they used the labels. While the majority of the subjects agreed that the labels were useful tools for consumers, far fewer reported actually using the labels themselves. When asked if they used the label to help them fit food into their daily diet, 3.4% responded always, 21.2% responded often, and 19.2% responded sometimes. More than half responded that they used the label rarely or never. 63.5% of the subjects said that when they do use labels, they check the serving size; this statistic becomes less impressive after realizing that less than half of the students surveyed use the nutrition facts label at all.

Portion Size Trends

In Food Portions and Servings: How Do They Differ? (Hogbin, Shaw, & Anand, 2001) examined the differences between the original Food Guide Pyramid servings, Nutrition Facts Labels servings, and the amounts that people actually eat. The original Food Guide Pyramid serving was a measurement unit created to describe the total daily amount of foods recommended from each of the food groups. According to the Food Guide Pyramid, larger portions count as more than one serving, while smaller portions count as partial servings. A food label serving is the specific amount of food that has the amount of nutrients listed on the Nutrition Facts Label. The 1990 Nutrition Labeling and Education Act (NLEA) specified amounts for almost 200 product categories. Serving sizes are expressed in household units such as cups, pieces, and ounces, in addition to grams. They are designed to reflect the amount that an individual might eat in a single sitting. The serving size in the original Food Guide Pyramid and the Nutrition Facts Label were the same for many food items, but not all. This is because the
Pyramid and the Nutrition Facts Label serve different purposes. The Food Guide Pyramid was designed to assist individuals in choosing a healthy diet, while the Nutrition Facts Label is designed to allow individuals to compare nutrients for different food products within a category. The United States Food and Drug Administration suggest using the Nutrition Facts Label serving size recommendation to curb energy intake. In both cases, the serving size may not actually reflect the amount that a person actually eats in one sitting.

Hogbin, et al, (1999) defined a portion as the amount of a specific food that an individual eats at an eating occasion. Portions can be larger or smaller than the servings listed by the Food Pyramid Guide or a food label. The USDA Continuing Survey of Food Intakes by Individuals reports that actual portion sizes are generally larger than serving sizes.

Many studies have shown that people tend to eat more when confronted with large amounts of food and larger portions have more calories. In a study designed to compare quantities consumed per eating occasion in 1989-1991 and 1994-1996, Smiciklas-Wright, Mitchell, Mickle, Goldman, and Cook (2003) found that significant differences in amounts consumed were reported for one-third of the 107 foods examined. The estimates of the amounts of foods commonly consumed were based on information provided by individuals participating in national food consumption surveys conducted by the United States Department of Agriculture. $T$ tests were used to compare quantities of foods consumed by survey respondents over the two time periods. The mean amount of ready to eat cereal (raisin bran or crispy rice) reported rose from 49g in 1989-1991 to 54g in 1994-1996. The mean for toasted oat rings cereal rose from 37g to 42g over the same time periods, while the mean for corn flakes rose from 40g to 46g over the same time periods. All of these cereals showed significant differences in the amounts consumed per eating occasion.
Young and Nestle (1998) conducted a study that showed most people cannot estimate the portion sizes of commonly consumed foods with accuracy. Dietary guidance materials that designate portion sizes by relative size, such as small, medium, or large, assume that people interpret these terms similarly. During the study, university students enrolled in an introductory nutrition class were asked to bring in a sample of a bagel, baked potato, muffin, or other designated food that they considered of medium size. Samples were weighed and compared to the “medium” designation in the Food Guide Pyramid. The bagels ranged from 2.0 ounces to 5.3 ounces with a mean of 3.9 ounces. 90.3% of the bagels brought in exceeded the 2.0 ounce designation for a “medium” bagel. 100% of the muffins and 100% of the baked potatoes brought in exceeded the Food Guide Pyramid designation for a “medium” in their respective groups. The students’ perception of “medium” revealed a wide variation.

Consumption Studies

Several studies have shown that in lab settings larger portions of food lead to increased energy intake. A study by Rolls, Morris, and Roe (2002) found that when subjects were offered increasingly larger portion sizes of macaroni and cheese over time, the subjects consumed increasingly larger amounts. Fifty-one subjects came to the laboratory to eat lunch on four different days, each day separated by one week. On each occasion the subjects were presented with a consecutively larger portion size: 500, 625, 750, or 1000 grams. Subjects were instructed to eat as much or as little of the macaroni and cheese as they desired. The food items were weighed before and after the meal to determine the amount consumed. The subjects were found to consume significantly greater amounts of the entrée as portion size increased. The subjects consumed 30% more energy when presented with the largest portion than when presented with
the smallest portion. Although the subjects’ food intake increased as portion size increased, none
of the subjects reported differing feelings of fullness after the meals.

Levitsky and Youn (2004) showed that college students will eat more if larger portions
are placed in front of them. Subjects were served a buffet lunch for three days during one week.
The subjects were instructed to take as much or as little as they wished. Each plate was weighed
before and after the meal to determine the amount consumed. A mean intake was determined and
used to create a baseline of 100% of mean intake, 125% of mean intake, and 150% of mean
amounts. The second week, the students were served these percentages of their baseline amounts
on different days. The researchers found that the larger the amount of food the subjects were
served, the more they consumed, with significant differences between each of the amounts. The
amount of food consumed had no association between the levels of hunger that the subjects
reported before the meal nor the amount of satiety the subjects reported after the meal.

The size of dishes that subjects serve themselves from can also effect how much the
subjects eat. Wansink and Cheney (2005) designed a study that allowed subjects to serve
themselves snack mix. Subjects were divided into two groups that were similar in participant
Body Mass Index, weight, hours since their last meal, age, education, and sex. The groups served
themselves from either large (4 L capacity) or medium (2 L capacity) bowls, respectively. The
plates were weighed and subjects were led to a table to watch a sporting event. One hour later,
the plates were weighed again to determine how much each subject had eaten. The subjects
serving from large bowls took 53% more and consumed 56% more than those served from
medium bowls. Wansink concluded that the size of a serving bowl or portion may provide
consumption cues that suggest the appropriate amount to eat. Larger bowls suggest that it is
appropriate to consume larger amounts of foods.
In the study entitled *Increased Portion Size Leads to Increased Energy Intake in a Restaurant Meal*, researchers found that, in a restaurant setting, increasing the size of an entree results in increased energy intake (Diliberti, Bordi, Conklin, Roe, & Rolls, 2004). The study was conducted at a public, cafeteria style restaurant on a university campus. The researcher recorded the food intake of customers who purchased a baked pasta entree. On five days the entree was the standard (100%) portion and on five different days the entree was increased to 150% of the standard portion. Customers who purchased the entree were asked to complete a short survey and only those who completed the survey were included in the study. The survey asked subjects to rate the appropriateness of the portion size, how the amount they ate compared with their usual lunch, the value for money of the meal, and the taste of the entree. Subjects were also asked to indicate their sex, age group, and university affiliation. A total of 180 subjects met the inclusion criteria. The study coordinator unobtrusively recorded the estimated body size of each subject as normal or underweight, overweight, or obese. The entree was weighed after baking and before being placed on the serving line and the uneaten portion was weighed after the meal.

Diliberti, et al. (2004) found that portion size had a significant effect on energy intake. When the 150% portion size was offered, customers consumed 43% more energy than customers who purchased the 100% portion size. None of the subject characteristics (sex, age group, university affiliation, body size) affected the relationship between portion size and energy intake. When subjects rated the amount that they had eaten on the survey, the rating did not differ significantly between those who had purchased the 150% and 100% portion sizes. This means that despite substantial differences in intake, subjects in the two groups did not differ in their estimation of how much they had eaten. The researchers found that the results of the study
supported the hypothesis that large portions in restaurants are associated with increased energy intake.
Chapter III: Methodology

Introduction

This chapter contains information about subject selection, the experimental design, data collection, data analysis, and limitations of the methodology.

Subject Selection and Description

Subjects for this study are volunteers meeting certain criteria: subjects were over eighteen years of age and self-reported a normal health status. Posters were put up in the Memorial Student Center at the University of Wisconsin-Stout in Menomonie, Wisconsin, informing passersby that the data collection would be conducted in room 140 of the Memorial Student Center. The posters stated that the data collection would take about 5 minutes of the participants time. Participants will read a consent form prior to beginning the study that stated their participation is voluntary and that they may stop at any time.

Instrumentation

In Portion Distortion: A Study of College Students, Bryant and Dundes (2005) designed a procedure to determine if college students could accurately assess designated serving sizes and whether this stated serving size accurately depicts their actual consumption. The procedure designed for this study will be constructed using Bryant and Dundes’ design as a template. This study differs from Bryant and Dundes’ design in significant ways. Because no available instruments were found that met the needs of this study, an original survey instrument and subject demographic form was designed by the researcher.

Data Collection Procedures

This study will not involve any false, misleading, or withheld information. Subjects are first asked to read a statement regarding the protection of human subjects and informed consent,
and will be asked to sign the form stating they understand. Subjects will complete a numbered registration form stating their gender, major, age, and frequency of cereal consumption. The number on the form will be used to correlate subject demographics with experiment results. All information is confidential. Subjects will be asked to pour the amount of cereal they would normally consume at one sitting into a bowl from a box of cereal (herein, referred to as Experiment 1). The bowl will be weighed immediately and the weight recorded on the registration form in grams. Subjects will be asked to read the nutritional label from the box of cereal, which reports that a serving of the cereal is 28 grams. Subjects are asked to then pour their estimation of a standard serving size of the cereal into a second bowl (herein referred to as Experiment 2). The bowl will be weighed immediately and the weight recorded on the registration form in grams. The same electronic scale will be used for all measurements to ensure internal reliability.

Data Analysis

The data collected from this study will be analyzed using the computerized statistics package STATA. The STATA statistics package is similar in format to SPSS and is used widely throughout the social and life sciences. Data, for both Experiment 1 and Experiment 2, will be analyzed first for summary statistics, including sample means, standard deviations from the mean, and minimum and maximum values. One-sample t-tests will be performed on the respective sample means from both Experiments 1 and 2, comparing the sample means to the actual cereal serving size of 28 grams. A paired t-test will be performed, comparing the sample means of Experiment 1 and Experiment 2. Further analysis will be conducted using demographic information collected from subjects. The sample means, standard deviations, minimum values, and maximum values for Experiment 1 and Experiment 2 will be divided by gender and age to
examine the effects gender or age may have on the knowledge of serving sizes. Regression analysis will be performed for each experiment using subject's gender, age, and the number of times they reported eating cereal each week. By combining these variables together and examining the sample means, the interaction of effects of variables will be examined.
Chapter IV: Results

Introduction

This chapter contains the results of the study. Demographic information and item analysis will be presented.

Demographic Information

A total of 43 subjects participated in the study. Seventeen subjects were male students (40%) while 25 subjects were female students (60%). Subjects were divided into three age groups: 28 subjects were less than 25 years of age (65%), ten subjects were 25-40 years of age (23%), and 5 subjects were over 40 years of age (12%).

Data Analysis

Data from Experiments 1 and 2 are summarized in Table 1. The sample mean for Experiment 1, in which subjects were asked to estimate the amount of cereal they eat at one sitting, was 48.567 grams, with a standard deviation of 11.121 grams, a minimum value of 27.4 grams and maximum value of 75.9 grams. The sample mean for Experiment 2, in which subjects were asked to estimate the amount of cereal that constituted a recommended serving size (actually 28 grams), 29.02 grams, with a standard deviation of 8.294 grams and a minimum value of 15.4 grams and a maximum value of 46.8 grams.

Table 1

<table>
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<tr>
<td>Experiment 1</td>
<td>42</td>
<td>48.567</td>
<td>11.121</td>
<td>27.4</td>
<td>75.9</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>42</td>
<td>29.92</td>
<td>8.294</td>
<td>15.4</td>
<td>46.8</td>
</tr>
</tbody>
</table>
A comparison of the sample means with the actual serving size can be seen in Figure 3.

![Figure 1: Comparison of Experiment Sample Means](image)

One-sample t-tests were performed on the respective sample means from both Experiments 1 and 2, comparing the sample means to the actual cereal serving size of 28 grams. The one-sample t-test for Experiment 1 showed that the sample mean of 48.567 grams was significantly different from the actual serving size of 28 grams ($t=11.985$). The one-sample t-test for Experiment 2 showed that the sample mean of 29.993 grams was not significantly different from the actual serving size of 28 grams ($t=1.592$).

A paired t-test was performed, comparing the sample means of Experiment 1 and Experiment 2. The t-value for the mean difference ($t=10.2818$) between the experiments showed that the means were significantly different, leading to the rejection of null hypothesis 1, and allowing for the conclusion that there is a significant difference between the amount of cereal subjects reported eating in a single sitting and the amount that they estimate constitutes a recommended serving size.
Further analysis was conducted using demographic information collected from subjects. The sample means, standard deviations, minimum values, and maximum values for Experiment 1 are shown divided by gender in Table 2. The sample means, standard deviations, minimum values, and maximum values for Experiment 2 are shown divided by gender in Table 3. Regression analysis shows that there is a significant difference between the sample means for men and women in Experiment 1. There was no significant difference between the sample means for men and women in Experiment 2.

Table 2

<table>
<thead>
<tr>
<th>Gender Differences in Experiment 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
</tr>
<tr>
<td>Men</td>
</tr>
<tr>
<td>Women</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Gender Differences in Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
</tr>
<tr>
<td>Men</td>
</tr>
<tr>
<td>Women</td>
</tr>
</tbody>
</table>

Subjects were divided into three age groups; under 25 years of age, 25-40 years of age, and over 40 years of age. Sample means, standard deviations, minimum values, and maximum
values were calculated for each age group for Experiment 1 (Table 4) and Experiment 2 (Table 5).

Table 4

<table>
<thead>
<tr>
<th>Age Group Differences in Experiment 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Age group 1: less than 25</td>
</tr>
<tr>
<td>Age group 2: less than 25-40</td>
</tr>
<tr>
<td>Age group 3: More than 40</td>
</tr>
</tbody>
</table>

Table 5

<table>
<thead>
<tr>
<th>Age Group Differences in Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Number of Observations</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Age group 1: less than 25</td>
</tr>
<tr>
<td>Age group 2: less than 25-40</td>
</tr>
<tr>
<td>Age group 3: More than 40</td>
</tr>
</tbody>
</table>

Regression analysis was performed for each experiment using subjects’ gender, age, and the number of times they reported eating cereal each week. Regression analysis of Experiment 1 with gender showed that there was a significant difference at α=.05 between the amounts that females reported eating at a sitting (45.656 grams) and the amount males reported eating at a sitting (52.847 grams) with α=0.038. Females on average poured 7.191 grams less than males into the bowl. Gender was the only significant variable under regression analysis of Experiment
1. When regression analysis included other variables (age group, times per week cereal is eaten) no variables were significant at $\alpha=.05$.

An identical regression analysis was performed for Experiment 2. No variables were significant at $\alpha=.05$. 
Chapter V: Discussion, Conclusion, and Recommendations

Discussion

The objectives of this study were met, in that, the size of a portion of cereal that students reported eating at one sitting was determined, the size of a portion of cereal that students believed to be a serving size was determined, the data from the two experiments was analyzed to see if there was a significant difference between the two portions, and the data from the two experiments was analyzed to determine if there were differences between different demographic groups.

It was determined that students report eating significantly more cereal at one sitting than they believe to be a serving size. This leads to the conclusion that students are aware that they are overeating. Students were able to recognize the amount of cereal that constitutes one serving and reported eating more than a serving size at one sitting despite the ability to recognize a serving size. Students are aware that they are overeating.

Men, in general, reported eating more than women, despite age and the number of times per week that cereal was eaten. In fact, when all demographics were combined in analysis, no demographic significantly explained the differences in amount of cereal eaten. All demographic groups were able to recognize a serving size of cereal, regardless of age, gender, and the number of times per week cereal was eaten.

The null hypothesis, that there will be no significant difference between the amount of cereal students identify as a portion to be consumed at one sitting and the recommended serving size, was rejected based on the collected data.
Conclusions

Despite evidence that suggests consumers do not seem to know what constitutes a serving size, making them unable to monitor whether they are over consuming, the data collected in this study suggests students do know what constitutes a serving size. Yet, they overeat anyway.

The United States Department of Health and Human Services suggests that special attention should be given to portion sizes. This suggestion becomes even more relevant after analysis of the data presented in this paper. As stated in the introduction, though there are no empirical studies to show a causal relationship between increased portion sizes and rates of obesity, there are studies showing that controlling portion sizes helps limit calorie intake (United States Department of Health and Human Services and United States Department of Agriculture, 2005, p.15). The data presented in this study suggests that students have the knowledge necessary to control their calorie intake, but are either choosing to ignore it or do not understand how to use the information. Stronger messages and more education advocating portion control may be necessary to curb the problem of overeating in the United States.

MyPyramid may address the issue of overeating. MyPyramid is designed to allow consumers to use the recommendations in a more effective manner through the incorporation of motivational and educational tools, MyPyramid provides an individualized context in which people may be able to apply the nutrition knowledge they already have. People may know what a serving looks like, but they may not know how to translate that into usable information, perhaps because they do not know how many servings they need in a day; MyPyramid may provide that information through the use of personalized eating plans created with interactive, on-line tools. College students are often heavy internet users, making the on-line format an ideal medium through which to address the issue of overeating.
The USDA’s elimination of the use of the term “serving” when describing the recommended amounts of food makes MyPyramid a more useful tool. This experiment supports the USDA’s claim that consumers considered a serving to be the portion on their plate, while nutrition professionals considered a serving to be a standardized amount of food (USDA, 2005). The students in this experiment did seem to differentiate between “serving” as the amount they eat at one time and “serving” as a recommended amount of food to eat at one time. MyPyramid’s description of recommended amounts of a food in cups or ounces per day may be useful in addressing overeating.

**Recommendations**

More research is recommended to address the issues of overeating and portion control. This experiment found there is a difference between the amount that students eat at one sitting and the recommended serving size, but students do know what a recommended serving size looks like. In other words, the subjects in this experiment could recognize the amount that constitutes a label’s recommended serving size, yet they reported eating significantly more at a single sitting. Additional research should address this discrepancy by determining the causes or reasons behind it and by examining how the discrepancy fits into a subject’s overall eating pattern. Especially important is determining if subjects are choosing to ignore the information they have or if they simply do not know how to apply the knowledge.

Several potential experiments could help clarify the pattern suggested by this experiment. Asking subjects to determine the amount they eat at one sitting and then asking them to determine the amount that constitutes a recommended serving without allowing them to read the label may determine if students know what a serving looks like rather than what a cup of cereal (the recommended serving on the box) looks like. A random experiment utilizing the same
methods as this experiment, in which one group, before pouring the cereal, is exposed to the old food guide pyramid and another group is exposed to the educational materials provided by the new MyPyramid could test the effectiveness of the new graphic.
References


Levitsky, D. A. & Youn, T. (2004). The more food young adults are served, the more they overeat. *Journal of Nutrition, 134*, 2546-2549.


Appendix A: Experiment Registration Form
College Students' Knowledge of Cereal Serving Sizes
Registration Form

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

____________________ Subject Number

1. What is your gender? Male Female

2. What is you age in years? ________

3. What is your major at Stout? ________

4. How many times per week do you eat cold cereal?

   1    2    3    4    5    6    7    More than 7

Results obtained from this study will be available on May 5, 2006 at UW-Stout Research Day. Results can also be obtained from the researcher, by sending an e-mail to ryaneli@uwstout.edu, after March 1, 2006. The results from this experiment will be used for a MS thesis and poster session. Results may be published. All individual results will remain confidential.
Appendix B: Experiment Directions
College Students’ Knowledge of Cereal Serving Sizes

Before starting this study, make sure that you have signed the informed consent form and filled out the numbered questionnaire.

1. Pour the amount of cereal that you would normally consume at one sitting in the first bowl. Give the bowl to the person supervising the study.

2. Find the nutrition information label on the side of the cereal box. Find the recommended serving size. Pour this amount into the second bowl. Give the bowl to the person supervising the study.

Thank-you!
Consent to Participate in UW-Stout Approved Research

Title: College Students' Knowledge of Cereal Serving Sizes

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715-232-2545 or 2183
barnhartc@uwstout.edu

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

Description:
The purpose of this study is to determine the serving size knowledge of students attending the University of Wisconsin – Stout during the fall of 2005. This study will measure student’s ability to identify recommended serving sizes and compare their perception of a recommended serving size with the amount that they report to consume at single sitting. Data will be collected in the Memorial Student Center. Students will be asked to pour the amount of cereal they would normally eat in one sitting into a bowl. Students will then be asked to read the nutrition information on the side of the box and then pour their estimation of a standard serving size of the cereal into a second bowl. The bowls will then be weighed to measure the amount the student believed was a serving. Each student will contribute to both the control group and the experimental group. The control group will be the bowls that contain the amount of cereal they would normally eat at one sitting. The experimental group will be the bowls that contain what they believe to be a recommended serving after reading the nutrition label. Bowls and boxes of cereal will be provided. A simple registration form will be given to each student and they will be asked to record their gender, major, age, and frequency of cereal consumption.

Risks and Benefits:
Obesity and overweight have become a US epidemic. This research will contribute to the body of knowledge that is being developed to combat this epidemic. This research will be a careful, systematic investigation and compilation of students' knowledge of portion size, a key element in weight control. Although there are no physical risks associated with this study, subjects may feel uncomfortable revealing information about the amount that they eat at a single sitting. There is a possibility of emotional discomfort attached to revealing this information.

Time Commitment and Payment:
Each subject will spend less than 5 minutes participating in the study. Granola bars will be given out at the end of the subject’s participation as a thank you. No other compensation will be given.

Confidentiality:
Subjects will fill out a numbered registration form stating their gender, major, age, and frequency of cereal consumption. The number on the form will match a number placed on the bowls that will be used in the study. The number on the form will be used to correlate subject characteristics with experiment results. No names, ids, e-mails, or other identifying characteristics will be requested. Names will not be included on any documents. Subjects can not be identified from any of this information. Results obtained from this study will be available on May 5, 2006 at UW-Stout Research Day. Results can also be obtained from the researcher, by sending an e-mail to ryaneli@uwstout.edu, after March 1, 2006. The results from this experiment will be used for a MS thesis and poster session. Results may be published. All individual results will remain confidential.

Right to Withdraw:
Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. Should you choose to participate and later wish to withdraw from the study, you may discontinue your participation at this time without incurring adverse consequences.

IRB Approval:
This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

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IRB Administrator
Sue Foxwell, Director, Research Services
152 Vocational Rehabilitation Bldg.

UW-Stout
Menomonie, WI 54751
Statement of Consent:
By signing this consent form you agree to participate in the project entitled, UW-Stout College Students’ Knowledge of Cereal Serving Sizes

______________________________________________________________
Signature............................................................................................ Date