

**Providing flexible food portions in a restaurant setting:
Impact on business operations, food consumption and
food waste.**

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Dedication

This thesis is dedicated to my B-boys.

Abstract

Large portion sizes in restaurants have been identified as a public health risk. The objectives of this study were to assess the impact of adding reduced-portion menu items to the menu on customer selection, energy and nutrient intake, plate waste and business operations. A field experiment was conducted to examine the impact of offering flexible portion sizes in 2 food service environments: a cafeteria setting and a sit-down restaurant setting in St. Paul MN. Patrons were surveyed at the beginning and end of the study to assess current usage, dining needs and frequency of healthful behaviors. Purchasing, consumption and food waste data were collected throughout the study. Reduced sized portions were added to the menus halfway through the study in the spring of 2013. The management teams were interviewed at the completion of the study. Sales data show that reduced-portion entrees made up 10-30% of entrée sales across both food service environments. Energy and nutrient intakes decreased and food waste was reduced at both locations. The management teams both reported the added items provided higher profit margins or cost savings and improved customer satisfaction. Both locations have implemented the menu changes indefinitely. These outcomes could serve as the foundation for future work with reduced-portion sized menu items in different types of restaurant settings to promote public health.

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List of Abbreviations

AFHFE:	Away from home food expenditure
BMI:	Body mass index
BRFSS:	Behavioral Risk Factor Surveillance System
CDC:	Centers for Disease Control and Prevention
CSFII:	Continuing Survey of Food Intakes by Individuals
DHKS:	Diet and Health Knowledge Survey
DRV:	Dietary Reference Value
EPA:	Environmental Protection Agency
ERS:	Economic Research Service
FAFH:	Food away from home
FAO:	Food and Agriculture Organization
FDA:	Food and Drug Administration
FWRA:	Food Waste Reduction Alliance
HEI:	Healthy Eating Index
MEPS:	Medical Expenditure Panel
NDSR:	Nutrition Data System for Research
NHANES:	National Health and Nutrition Examination Survey
NRDC:	Natural Resources Defense Council
TCC:	Town and Country Club
US:	United States
USDA:	U. S. Department of Agriculture

Chapter 1: Literature Review

Increased consumption of Food Away From Home (FAFH)

During the past 40 years, the amount of food consumed outside of the home has increased tremendously in the United States (US).^{1,2,3} The National Restaurant Association reported that restaurant industry sales have increased from \$42.8 billion dollars in 1970 to \$683.4 billion dollars in projected sales for 2014.¹ The percentage of food dollars spent on food away from home (FAFH) has increased from 25.9% in 1970 to 43.1% in 2012 based on annual analysis of US food consumption and production by the US Department of Agriculture (USDA) Economic Research Service (ERS).² Data from a flexible consumer behavior survey conducted by USDA showed that more than 80% of individuals ate at least one meal prepared away from home weekly and roughly 25% of individuals consumed 5 or more meals prepared away from home weekly.³

Concurrent with the increased consumption of FAFH has been a rise in the obesity rates of Americans. According to the Centers for Disease Control and Prevention (CDC), an adult with a Body Mass Index (BMI) [$\text{weight (kg)} / (\text{height (m)})^2$] between 25 and 29.9 is considered overweight and an adult with a BMI above 30 is considered obese.⁴ Children are considered overweight if their BMI is between the 85th and 95th percentile and obese if they exceed the 95th percentile for children of the same age and gender.⁵

A 2014 analysis of data from the 2011-2012 National Health and Nutrition Examination Survey (NHANES) indicates that 68.5% of American adults are overweight or obese.⁶ Almost 35% of adults and 17% of children and adolescents are considered obese.⁶ Obesity rates have risen dramatically in recent decades, more than doubling for adults and children 6-11 years^{6,7,8} and quadrupling for adolescents since 1980.^{6,8}

Obesity has become a public health crisis in America. Being overweight or obese is a risk factor for many diseases and conditions, including type 2 diabetes, hypertension, coronary heart disease, stroke, dyslipidemia, liver and gallbladder disease, sleep apnea, osteoarthritis and certain types of cancer.^{9,10} Analysis of data from 1998 and 2006 Medical Expenditure Panel Surveys (MEPS) found that health problems related to obesity are costing Americans over \$147 billion dollars annually.¹¹

Because the rise in obesity has paralleled the rise in FAFH consumption, numerous studies have investigated both the nutritional quality of restaurant foods^{12,13,14,15,16,17,18,19,20,21} and the portion sizes of restaurant foods^{22,23,24,25,26,27} to determine the impact these factors have on rising obesity rates.

Nutritional Quality of Restaurant Meals

Numerous studies have examined the nutritional quality of FAFH and have found FAFH to be high in calories and nutrients of concern and associated with reduced diet quality and increased obesity in adults.^{12,13,14,15,16,17,18,19,20,21}

McCrary et al. (1999)¹² examined food frequency questionnaires for 73 healthy adult men and women. Frequency of food consumption from 7 different types of restaurants (pizza, Mexican, burger, Chinese, fried chicken, fried fish and “other”) was measured. Body fatness was associated with greater frequency of restaurant food consumption. Because of the small sample size, it is unclear if this association is representative of adults nationally. Therefore, a number of studies have utilized national survey data to examine the association of FAFH consumption with diet quality and obesity.^{13,14,15,16,17,18}

An examination of the changes in FAFH frequency and diet quality utilizing data for individuals over 2 years from USDA’s 1977-78 and 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) found that calories from FAFH increase from 18% to 32% of total calories.¹³ FAFH was also higher in calories, fat, and saturated fat and lower in fiber, calcium and iron than meals prepared at home.

A 2004 study focusing on the impact of fast food intake on diet quality was based on data analysis for adults over 20 years from the USDA’s 1994-1996 CSFII.¹⁴ Those who reported eating fast food consumed significantly higher amounts of calories, fat, saturated fat, carbohydrates, sugar and protein than those who did not consume fast food. They also reported lower consumption of fruits and dairy and lower intakes of calcium, magnesium, vitamin A, and vitamin C.

Kant et al. (2004)¹⁵ examined the impact of commercially prepared food on diet quality using data from adults over age 18 from the 1997 and 1999 National Health Interview Survey and the 1999-2000 NHANES. Results showed an increase in the frequency of eating commercially prepared food. They also found a positive association between BMI and the number of commercially prepared meals consumed ($p \leq 0.0001$).

A 2008 study analyzed dietary data for US adults aged 20-65 from the 1994-96 CSFII and the CSFII/Diet and Health Knowledge Survey (DHKS).¹⁶ Increased away-from-home food expenditures (AFHFE) were associated with lower diet quality measures, such as increased fat and saturated fat, lower levels of fiber and lower Healthy Eating Index (HEI) scores. The HEI is a measure of diet quality assessing adherence to the 2010 Dietary Guidelines for Americans.^{28,29}

A more recent study compared dietary intake data for adults over age 20 on 2 non-consecutive days from the 1994-96 CSFII and 2003-04 NHANES to examine how changes in the number of meals eaten outside the home impact dietary quality. Mancino et al (2009)¹⁷ Greater intakes of FAFH increased calorie, saturated fat and sodium intakes as compared to meals consumed at home. Each meal consumed outside of the home added an additional 130 calories on average to the daily total intake and decreased HEI scores by 2 points. The additional calories were estimated to add about 2 pounds each year. A subsequent study extended this analysis to examine the effect of FAFH on fruit,

vegetable and whole grain intakes.¹⁸ Eating out reduced the dietary density of fruit in the diet by 15.5-22.3%, whole grain by 12.2 – 26.4%, dairy by 8.6 – 11.8%, and total vegetables by 8.7%.

In addition to the studies analyzing survey data, recent studies^{19,20,21} have also examined the nutritional quality of restaurant meals by analyzing the nutritional information provided by restaurants. Two studies conducted by Wu and Sturm (2012, 2013)^{19,20} examined the nutritional quality of foods served in the top chain restaurants in the US based on a list of the top 400 restaurant chains by *Restaurants and Institutions* magazine. The first study¹⁹ was conducted prior to the passage of the Affordable Care Act,³⁰ requiring national nutrition labeling. Nutrition information was collected for 245 restaurant chains, via website or e-mail request. While the majority of the entrees (without sides) were within one third of the USDA's estimated adult energy needs of 2000 calories/day, most were high in sodium, fat and saturated fat. Overall, 96% of the entrees exceeded the USDA guidelines for calories, fat, sodium and/or saturated fat.

A follow-up study conducted within one-year passage of the Affordable Care Act,³⁰ examined changes in the energy and sodium content of menu offerings.²⁰ Utilizing the same list of the top 400 restaurants, nutrition information was collected for 213 restaurant chains. While many restaurants had made menu changes during the year, evidence of improved nutritional quality was not found.

New menu items tended to be equally high in calories and sodium as the items they replaced.

A similar study²¹ examined the menus of 21 full-service restaurant chains in the Philadelphia area after the passage of local menu labeling legislation.³¹ A total of 2,615 menu items, including appetizers, entrees, side dishes, desserts and a variety of drinks were analyzed for energy and nutrient content. Meals consisting of an entrée and sides along with half of an appetizer averaged 1,495 calories, 28 grams (g) saturated fat, 3,312 milligrams (mg) sodium, and 11 g fiber. Adding a nonalcoholic drink and one-half of a dessert added a mean of 2,020 calories, 39 g saturated fat, 3,760 mg sodium and 12 g fiber. In addition, menu items labeled as “healthy choices” were only found on half of the menus and the number of choices was limited.

These studies show that eating FAFH is associated with higher caloric intake as well as higher intakes of fat and saturated fat and lower intakes of vegetables, fruits, whole grains and other key nutrients. While it may be possible to find healthy options at some restaurants; the majority of FAFH is high in calories, fat and sodium and low in nutritional quality.

Restaurant Portion Sizes

Concurrent with the rise in obesity and increased meals eaten outside the home, portion sizes of meals served at restaurants in the US have risen dramatically^{22,23,24} Similar increases have been seen globally.^{25,26,27} The trend

toward larger portion sizes at restaurants in the US began in the 1970's. and portion sizes have continued to rise.²²

Considerable evidence exists to confirm an increase in portion sizes at restaurants in the US since the 1970's. Young and Nestle (2002)²² examined portion sizes of foods available at family style, fast food and take-out restaurants and compared them with the current federal standards. The current portions were also compared with portion sizes available in previous years. All items, with the exception of sliced white bread, exceeded the USDA and US Food and Drug Administration (FDA) standards by as much as 700%. When compared to their original portion sizes, most items available at the time of the study were larger, with some, such as soda, as much as 2-5 times larger.

Nielson (2003)²³ examined the trends in portion size consumption of foods available at stores, restaurants and fast food establishments by analyzing data from 63,380 individuals aged 2 and older from the Nationwide Food Consumption Survey in 1977-1978 1989–1991, 1994-1996 and 1998 CSFII. Portion sizes and energy intake for all foods except pizza increased between 1977 and 1996.

Piernas and Popkin (2011)²⁴ examined changes in portion sizes of foods commonly eaten by children, such as pizza, soft drinks, burgers, fries, etc. available in stores, restaurants and fast food establishments. Data from 31,337 children ages 12-18 were examined from 4 USDA food intake surveys; the 1777-1778 USDA Nationwide Food Consumption Survey, the 1989 – 1991 CSFII, the 1994–1996 and 1998 CSFII and combined NHANES data from 2003–2004

and 2005–2006. Portion sizes for all foods examined, except for desserts, were significantly increased. Larger portion sizes resulted in greater energy intake for certain foods, such as pizza, (+172 calories/portion since 1977-78).

These studies show that the portion sizes of FAFH have increased over the past 30 years. Large portion sizes along with the high caloric content of FAFH and increased consumption of FAFH, may contribute to the rising obesity rates in the US.

Menu Labeling & Public Policy

Higher rates of obesity along with an increased prevalence of eating away from home has led to legislation at the local, state and national levels. The intent of legislation has been to both inform consumers about the caloric and nutritional content of food available at restaurants and to encourage greater availability of healthy food choices. Policy approaches have included banning certain ingredients, such as trans fats,³² limiting building permits for fast food restaurants,³³ placing requirements on children's meals,³⁴ and the most commonly utilized approach – menu labeling. Menu labeling regulation encourages restaurant patrons to select healthier food choices, yet a secondary goal is to encourage restaurants to offer healthier menu options. Several cities and counties, such as New York,³⁵ Philadelphia,³⁶ and King County, WA³⁷ have enacted restaurant menu labeling laws, which require restaurants to post caloric information by each menu item. Menu labeling will soon be required nationally.

The Patient Protection and Affordable Health Care Act³⁰ was passed in 2010. The FDA proposed guidelines for the law in 2011,³⁸ however the final version has not yet been released. The law requires restaurant chains with more than 20 outlets to post caloric information for all menu items on menus or menu boards. They must also post a health statement highlighting the recommended daily caloric intake for the average person and provide additional nutritional information for all menu items upon request.³⁹

A recent CDC study utilized survey data for adults from 17 states that used the Sugar Sweetened Beverages and Menu Labeling optional module from the 2012 Behavioral Risk Factor Surveillance System (BRFSS) survey.⁴⁰ Most (97%) respondents reported noticing menu labeling at restaurants and 57% indicated they used the menu labels to decide what to order. In all states, women utilized menu labels more than men. While this study shows a large percentage of adults notice and utilize menu labels at restaurants, it does not show the impact of menu labeling on the nutritional quality of items purchased or consumed. Therefore, this literature review will focus on the studies conducted in restaurant settings since the introduction of menu labels in New York City, Philadelphia and King County, as this may be the most relevant baseline to determine the impact of menu labeling on actual consumer purchasing and consumption.

Elbel et al. (2009)⁴¹ examined survey and receipt data collected in 14 New York City and 5 matched New Jersey (no labels) fast-food restaurants 1 month

before and 2 months after calorie labeling was implemented in New York City. Calories purchased post labeling were compared to same store purchases prior to menu labeling as well as compared to purchasing changes at matched New Jersey restaurants. Although 54% of surveyed customers noticed the menu labels in New York City and 27.7% indicated utilizing them to make menu choice, calories purchased were not significantly different compared to same store pre labeling purchases. Significant differences were also not observed in the New Jersey restaurants.

Pulos and Leng (2010)⁴² analyzed entrée sales data from 6 full service restaurants collected for 3 months before and 3 months after the introduction of menu labels in Pierce County, Washington. Although not significant, study results showed that after nutrition information was added to the menu, decreases of 15 calories, 1.5 g fat, and 45 mg sodium were observed for the average entrée purchased.

Similarly, an examination of transaction data at a Mexican restaurant chain for 13 months after the introduction of menu labeling in King County, WA found no significant change in purchasing behavior.⁴³

Another long term study collected data 9 months before the introduction of menu labeling and 1-year after at 168 fast-food restaurant locations in New York City.⁴⁴ Findings showed that 15% of customers reported using the calorie information and that these customers purchased 106 fewer calories than those who did not utilize the calorie information. Overall, there was no significant

change in mean calories purchased, however some individual restaurant brands showed a significant decrease in mean calories purchased (McDonalds, Au Bon Pan, and KFC), while others showed a significant increase (Subway).

An examination of transaction records at Starbucks in New York City over a 14-month period following the introduction of menu labeling showed a significant change in calories purchased.⁴⁵ Transaction records for New York City stores were compared with transaction records from Boston and Philadelphia stores, which lacked menu labels. Calories per transaction were 6% lower in New York City.

Most recently, Auchincloss et al. (2013)⁴⁶ conducted a cross-sectional study comparing transactions at 7 restaurant outlets in a large full-service restaurant chain 1 year after the implementation of menu labeling. Transaction records at 5 restaurant outlets with menu labeling were compared to 2 outlets without menu labeling. Customers at the restaurants that included menu labels purchased food with 151 fewer calories, 224 mg less sodium, and 3.7 g less saturated fat compared to customers at the unlabeled restaurants. Customers, who indicated that the nutrition information affected their order, ordered 400 fewer calories, 370 mg less sodium and 10 g less saturated fat.

The strengths of these studies include real world consumers and examination of actual purchases. Many studies examined changes in calories purchased before and after menu labeling or compared calories purchased within matched restaurants in locations without menu labeling. Most studies included

data collection over a long period of time, which addresses the sustained impact of menu labeling. However, nutritional analysis data were primarily based on purchased food items, rather than foods consumed by customers. The lack of food consumption measurements to assess food and nutrient intakes from customer food purchases is a major limitation for all of these studies.

These studies highlight the inconsistent results of many menu-labeling studies. While some studies show a significant decrease in calories purchased,^{45,46} some show mixed results⁴⁴ and others do not find any significant differences compared to calories purchased before menu labeling.^{41,42,43} This lack of consistency makes it difficult to predict whether the nationwide requirements of menu labeling will be effective in encouraging restaurant patrons to make healthier choices.

Although a secondary goal of restaurant menu labeling is to encourage restaurants to offer healthier menu items, studies assessing menu changes since the introduction of menu labeling are limited. Additional studies need to examine the changes in offerings in restaurants. Wu and Sturm conducted a series of studies^{19,20} examining the ability of menu labeling to change calorie and sodium levels in foods during the first year following the requirement of menu labeling in New York City and found no significant changes. These results contradict a study by Bruemmer et al. (2012),⁴⁷ that compared calories, saturated fat and sodium levels prior to menu labeling and during an 18-month follow-up in King County,

WA. A significant decrease in the calorie content of meals ($p < 0.0001$) after menu labeling was observed.

Auchincloss et al (2014)²¹ analyzed 21 full-service restaurant menus after Philadelphia menu labeling requirements went into effect. Menu items were compared against Dietary Reference Values (DRVs) based on a 2000 calories/day diet. *A la carte* entrees were found to exceed recommended levels if they surpassed 40% of DRVs for entrees and 10% of DRVs for side dishes. Calorie, saturated fat and sodium levels exceeded DRVs for a single meal and often exceeded daily DRVs. Additional studies also found that customers ordered meals exceeding 1/3 of the USDA's estimated adult energy needs of 2000 calories/day after the implementation of menu labeling.^{44,48,49,50}

Although Brummer et al. (2012)⁴⁷ observed significant reductions in calorie levels of meals offered after the implementation of menu labeling; most studies found no change or that menu items continued to exceed recommended levels. It is unclear from these studies, whether the introduction of nationwide menu labeling will encourage restaurants to offer healthier menu items.

One additional limitation with the current menu labeling legislation is that it only applies to chain restaurants with more than 20 outlets, which means many independent and locally owned restaurants do not need to follow these regulations. One study examined the feasibility of menu labeling in locally owned restaurants, a project conducted by the Tacoma-Pierce County Health Department recruited 24 locally-owned restaurants to voluntarily add nutrition

information to their menus. Throughout the process, researchers identified significant barriers to menu labeling at local restaurants; such as the need for standardize recipes, large time commitment required, and high costs associated with nutrient analysis.⁵¹

Because of the lack of clarity on the effectiveness of menu labeling legislation, alternative approaches should be considered, such as reduced-portion sizes. Other approaches may be necessary to improve the healthfulness of restaurant meals and change eating behaviors to impact the obesity epidemic in the US.

Portion Size and Energy Intake

Increases in portion size have been shown to increase energy consumption across several age groups. Numerous studies have shown increased energy intake in adults with larger portion sizes.

^{52,53,54,55,56,57,58,59,60,61,62,63,64,65} Additional studies with children have shown similar results. ^{66,67,68,69,70,71,72,73} The influence of portion sizes on adult energy intake will be explored based on research using varying study designs and settings.

Increased Portion Sizes – Lab Based – Single Occasion

Several controlled studies with adults have demonstrated in a laboratory setting that increased portion sizes are correlated with increased energy intake.^{53,54,55,56,64} A series of laboratory-based studies were conducted at Penn

State to investigate the effects of large portion sizes on energy intake. The first study⁵³ utilized a between-person experimental design and served participants a macaroni and cheese dish in 4 different portion sizes (500g, 625g, 750g and 1,000g) one day a week over 4 weeks. Participants were divided into 2 groups, a self-serve group or a pre-served group. Food was weighed before and after the meal to determine the amount consumed. In this group of 51 men and women, a significant increase in energy intake ($P < 0.05$) was observed with increasing portion sizes (546, 610, 652 and 708 calories, respectively). The increase in portion⁵³ amounted to a 30% increase in energy intake when the 1,000 g portion was served compared to the 500 g portion. Additionally, no interaction was observed between energy intake and serving method and no significant differences were observed in ratings of hunger and fullness, despite increased consumption with larger portion size.

A second study by Rolls, Roe and Meengs (2004)⁵⁴ investigated the effect of increasing food portion size on energy intake when served as a discrete unit. One day a week over 4 weeks, 75 men and women were served a submarine sandwich in 4 different sizes (6, 8, 10, or 12 inches). Sandwiches were weighed before and after the meal to determine the amount consumed. Both men and women significantly increased their energy intake ($P < 0.0001$) when served the 12-inch sandwich compared to the 8-inch sandwich. Women consumed 74 additional calories, which represented a 12% increase in energy intake and men consumed 186 additional calories, which represented a 23% increase in energy

intake. Again no significant differences were found in ratings of hunger and fullness, despite increased consumption.

A third study by Rolls et al. (2004)⁵⁵ examined the effect of portion size of a prepackaged snack on both snack consumption and consumption at the subsequent meal. Potato chips were served in one of 5 different sized packages: 28g, 42g, 85g, 128g or 170g along with 1 liter of water to 51 men and women on 5 separate days. All foods (snack and subsequent meal) were weighed before and after the snack or meal to determine the amount consumed. Both men and women ate significantly more potato chips ($P < 0.0001$) as the package size increased. Men consumed an additional 311 calories and women an additional 184 calories from the largest package compared to the smallest package. Participants also returned ~3 hours later to eat a standardized dinner. Combined energy intake for both snack and dinner was significantly higher for women ($p < 0.023$) and men ($p < 0.0001$) as the package size of the potato chips increased. The mean energy intake for snack and dinner combined increased by 143 calories when comparing the largest package to the smallest package.

Geier, Rozin and Doros (2006)⁶⁰ suggested that *unit bias* can lead to increased consumption when larger portion sizes are offered which corroborates the findings of Rolls et al. (2004a)⁵³ and Rolls et al. (2004b).⁵⁴ *Unit bias* was described as “a sense that a single entity (within a reasonable range of sizes) is the appropriate amount to engage, consume, or consider”.⁶⁰ Thus when larger-sized units of food were served, individuals would eat more because they

interpret a unit, regardless of size, as an appropriate amount to eat. The researchers conducted a number of small experiments with free snacks offered in public settings and found that the amount of food selected increased as the unit size increased. This study has limitations however, because it did not measure actual consumption, only the amount selected.

A study examining the effect of serving larger portion sizes to 13 young adults also observed that energy intake was significantly increased.⁵⁶ Rather than providing a set amount of food for all participants, this study established a baseline consumption level for each participant. Participants were instructed to consume as much as they wanted from a buffet lunch consisting of vegetable soup, rigatoni pasta and tomato sauce, breadsticks, ice cream and water during 3 meals over the course of 1 week. The mean energy intake was calculated and used as the baseline portion size. During the following week, participants consumed the same meal at 100%, 125% and 150% of baseline. Increased consumption was found for all components of the meal with the larger portion sizes ($p < 0.01$). Mean energy intake increased by 165 calories for the 125% portion compared to the control (100%) and increased 105 calories for the 150% portion compared to the 125% portion.

Rolls et al. (2010)⁶⁴ examined whether larger portion sizes of low energy dense foods like vegetables would also lead to increased consumption. Rolls conducted 2 crossover-design studies. In the first, 49 men and women were served 3 meals consisting of a vegetable, grain and meat on the same weekday

at least one week apart. The grain and meat portion of the meal were the same, however 3 different portions of vegetables were served: 180g, 270g, and 360g. In the second study, 48 men and women were served the same 3 meals, but as the vegetable portion increased, the meat and grain portion weights were decreased proportionally, so the vegetable portion increased but there was not an increase in the total amount of food served. Both studies reported significant increases in the amount of vegetable consumed as the portion size increased. In the first study, no significant difference was observed in the amount of meat and grain consumed with the larger vegetable portion sizes, thus leading to an increase in calories consumed with the larger vegetable portions. In the second study, consumption levels of the meat and grain decreased as the vegetable portion sizes increased, thus an increase in calories consumed was not observed.

These controlled laboratory studies all showed that adults increased their energy intake when exposed to increased portion sizes in a single meal, regardless of the energy density of the food or whether the food was amorphous in shape, served in units or pre-packaged. Additional studies need to be conducted to determine whether increased portion sizes would impact energy intake beyond the subsequent meal, and if this effect would occur outside of the laboratory setting.

Increased Portion Sizes – Lab Based – Multiple Days

To determine if a portion size effect would be sustained beyond a single meal or if compensatory mechanisms would reduce intake in subsequent meals Rolls, Roe, Meengs (2006)⁵⁹ conducted an additional study. In a within subject randomized crossover study, 32 men and women ate breakfast, lunch, and dinner in the laboratory and were provided snacks to be consumed mid-morning, mid-afternoon and evening away from the lab for 2 consecutive days in each of 3 weeks. Each week participants were provided the same meal, but the portion sizes varied from 100%, 150% and 200% of baseline amount. Hunger and fullness ratings were collected after each meal. As with individual meals, portion sizes had a significant impact on energy intake over the 2 days ($P < 0.0001$). When served the 150% portion, energy intake increased 16% and when served the 200% portion, energy intake increased 26%. No difference in the amount consumed between the 2 days was observed. Fullness ratings increased significantly from the 100% to 150% servings ($P < 0.0004$) but no significant differences were observed between the 150% and 200% servings.

An examination of 7-day food diaries found that energy intake on a particular day had a significant influence on the amount consumed 2 days later, suggesting a delayed compensatory adjustment.⁷⁵ To test whether the sustained increased energy intake would be maintained beyond the 2 days or if compensatory mechanisms would lower intake after 2 days, Rolls, Roe and Meengs (2007)⁶¹ conducted an longer-term study to examine the impact of large

portion sizes on energy intake over 11 days. This study used a crossover design similar to their previous study (Rolls, Roe, Meengs 2006).⁵⁹ All meals, snacks and drinks were provided for 27 participants over the course of 2, 11-consecutive-day periods, separated by a washout period of 2 weeks. The same foods were provided for each 11-day period, however during 1 period, participants received baseline portion sizes and during the second period they received portion sizes 50% larger. Increasing the portion sizes resulted in a significant increase in energy intake over the 11 days ($P < 0.0001$), with an average daily calorie increase of 423 calories. The larger portion sizes led to a 25% increase in daily energy intake for women and a 14% increase for men. The increased consumption was sustained throughout the entire 11 days of the study resulting in an average cumulative increase of 4,636 calories, thus contradicting the compensatory adjustment at 2 days suggested by De Castro (1995).

Both studies showed a sustained increase in energy intake, however participants were required to eat 3 meals a day in a laboratory setting at set times.^{59,61} Participants were not able to delay or eliminate a subsequent meal or choose a lighter, less energy dense meal to compensate, therefore, measuring potential physical compensation mechanisms that may occur in a naturalistic setting was not possible.

Similar findings were found in a randomized within-subject crossover design study in the United Kingdom (UK).⁶³ In this study 43 men and women were housed at a University over two 4-day periods. Each test condition was

separated by 3 weeks. Participants received all meals and snacks during the study. During 1 condition, participants were served standard portions and during the other condition they were served “large” portions, based on commercially available units of the same food designed to feed 2-3 people. Participants chose the menu items during the first period and then were provided different portions of the same items during the second period. Different serving dishes were used to mask the difference in portion sizes. Mean energy intake was significantly larger during the “large” portion size period ($p=0.020$). Energy intake increased by 17% for men and 10% for women when compared to the standard period. Kelly et al. (2009) also reported sustained energy intake over the 4 test days supporting the findings of Rolls, Roe and Meengs (2006)⁵⁹ and Rolls, Roe and Meengs (2007).⁶¹

Increased Portion Size - Naturalistic Environment – Single Occasion

A number of studies have been conducted to examine whether increased portion sizes would impact energy intake in a naturalistic environment.^{52,57,58}

Diliberti et al. (2004)⁵⁷ conducted a between subjects parallel group design experiment in a university cafeteria. Food intake was recorded for customers who purchased a baked pasta dish. The baked pasta dish was served 10 times over the course of 5 months. The standard (100%) portion was served 5 times and the large (150%) portion was served 5 times. Study weeks were separated by at least 2 weeks and the portion size served each week was determined randomly.

Customers (n=180) who purchased the pasta dish and completed a survey were included in the study. When the large portion of the pasta was served, customers consumed 43% more energy from the entrée and 25% more energy from the entire meal including side dishes. Despite differences in entrée size, ratings of portion size appropriateness did not change between the customers who purchased the standard and the large entrée size.

Two experiments were conducted at a movie theater to examine if external cues such as the size of a container could influence how much a person eats. In the first study⁵² customers (n=161) attending the movie were given coupons for a free popcorn and soda and were randomly provided either a medium (120g) or a large (240g) bucket of popcorn. Buckets were collected after the movie and 151 people completed a survey regarding the popcorn. Customers who rated the popcorn unfavorably ate 61% more in a large bucket than a medium bucket. Those who rated the popcorn favorably consumed 49% more in the large bucket than the medium bucket. In this study, taste differences in the popcorn were measured but not manipulated. In 2004, this experiment was repeated, however this time the taste of the popcorn was manipulated by providing some study participants fresh popcorn and others 14-day-old stale popcorn.⁵⁸ One hundred fifty eight moviegoers were randomly assigned to receive either a large bucket of fresh popcorn, a medium bucket of fresh popcorn, a large bucket of 14-day-old stale popcorn, or a medium bucket of 14-day-old stale popcorn. Of the fresh popcorn, participants who received a large

bucket ate 45.3% more popcorn than those who received the medium bucket. Even when survey data indicated participants disliked the stale popcorn, they still ate 33% more from the large bucket compared to the medium bucket.

Not only did these studies show that increased portion sizes positively impacted energy intake, they show a greater increase in energy intake than in laboratory settings. This may be due to other environmental factors or social cues that encourage increased consumption.

Increased Portion Sizes - Naturalistic Environment – Multiple Days

Although laboratory experiments have shown a sustained energy intake for up to 11 days, the 3 previous naturalistic studies^{52,57,58} only examined the impact of large portion sizes on a single eating episode. Two studies among adults^{62,65} have examined energy intake over longer periods of time in a naturalistic setting. These studies also examined changes in participant weight. The first study examined the effects of small or large portion-sized lunches on energy intake over 4 weeks.⁶² In a randomized crossover design, 19 women received either a large or small lunch 5 times per week for 4 weeks, then after a 2-week washout period, received the opposite condition meals for an additional 4 weeks. Meals consisted of a main dish (sandwich or salad), side (fruit, veg, chips, bread), a dessert (cookie or bar) and a drink (water, diet Coke, or Sprite). Small lunches averaged 767 calories and large lunches averaged 1528 calories.

Height and weight were measured at baseline and immediately after the completion of each of the 4-week study periods. Dietary assessment was measured after each lunch via a self-administered questionnaire where participants estimated the portion eaten using a visual analog scale. They also recorded any additional food items consumed for lunch. Two 24-hour dietary recalls were completed on random days during each 4-week intervention period. Physical activity was also assessed.

Findings showed that the average reported intake for the small lunch was 687 calories and 1,019 calories for the large lunch. Total daily calorie intake also differed. During the small lunch intervention period average daily intake was 1875 calories, whereas during the large lunch intervention period daily intake increased to 2153 calories. Researchers noted that this 278-calories/day increase could result in a 0.72 kg increase in participant weight over 20 days if not compensated for at a later time. They saw a 0.06 ± 1.03 kg weight gain during the small lunch period and a 0.64 ± 1.16 kg gain during the large lunch period.

A more recent study examined the effects of large portion sizes in a free-living environment over a 6-month period.⁶⁵ In a randomized controlled trial at a large metropolitan medical center with over 2,000 full-time employees, 233 adult participants, with a mean BMI of 29.8 were randomized to 1 of 4 lunch conditions; 400 calories (n=57); 800 calories (n=59), 1,600 calories (n=56); and control (n=61). Lunch was provided Monday through Friday for the participants in the 400, 800 and 1,600 calories groups. Fifteen different boxed lunch menus

were developed and similar foods were included in all calorie conditions. No lunch was provided for the control group participants.

Height and weight were measured and energy intake was assessed by 3 unannounced 24-hour dietary recalls at baseline, 1 month, 3 months and 6 months for a total of 12 recalls per person throughout the study. Physical activity was measured at baseline and at 6 months. Energy intake from lunch was significantly higher in the 800 and 1,600 calories groups ($p < 0.0001$) than the lower calories group. Total energy intake for the 1,600 calories group was significantly higher than the 800 and 400 calories groups. The participants in the 1,600 calories group also showed significant weight gain during the 6-month study, whereas the 400 and 800 calories groups did not.

Both of these studies have a number of strengths including their long-term duration; naturalistic settings and that they examined body weight to see if long-term exposure to large portion sizes leads to weight gain. While there is some error inherent with a 24-hour recall, these studies are better able to examine potential compensatory mechanisms because they are only manipulating 1 meal and are then able to examine any self-directed alterations to subsequent meals.

Reduced-portion Sizes - Lab and Naturalistic Environments

Relatively few studies have examined the effect of reduced-portion sizes on energy intake among adults. Rolls, Roe & Meengs (2006)⁷⁵ investigated the impact of providing meals with reduced-portion sizes and reduced energy density

to study participants over 2 days. Reductions in both portion size and reductions in energy density independently decreased energy intake. This reduction in energy intake was sustained over the course of the full 2 days.

Freedman and Brochado (2010)⁷⁶ examined the effects of reducing portion sizes on food intake and plate waste in a University all-you-can-eat-cafeteria setting. Over the course of the study researchers measured student intake of French fries purchased at the cafeteria. French fries were originally served in bags weighing 88 g. Each week the bags were reduced by 15 g and ended at 44 g. Bags were pre-weighed to ensure consistent weights. Researchers counted the number of bags taken by each person, 1, 2, or 3 or more. When diners were finished eating, bags and uneaten fries were collected. Uneaten French fries were placed in separate containers based on how many bags of French fries were taken. Findings showed that as the portion size of French fries was reduced, consumption levels and plate waste also decreased. This study has limitations however, because it was unable to determine if diners returned to get additional French fries during the meal or compensated with increased intake of other meal components.

A 3-part field experiment conducted in a Chinese fast food restaurant offered adult customers the ability to downsize portions of starchy side dishes.⁷⁷ While less than 1% spontaneously asked for reduced-portions, 23% accepted reduced-portions when offered in two conditions, either for no discount in price or in exchange for a 25¢ discount. In the second part of the study, reduced size

portions were offered. In the third part, the plates of 263 consumers were weighed at the end of the meal. No significant difference was found in the amount of leftovers, despite the difference in initial portion sizes. Consumers who downsized their side dishes consumed less energy than those who did not. Customer surveys indicated that those who selected the reduced-portion did so to reduce calories.

Increasing portion sizes has consistently led to increased caloric consumption and decreasing portion sizes led to decreased caloric consumption. Reducing restaurant portion sizes may be an effective way to increase the healthfulness of restaurant meals and reduce obesity rates, but it needs to be feasible and economical for restaurants to offer reduce portion sizes.

Practicality of Reduced Sized Restaurant Portions

Restaurant profit margins are key to determining which menu items are served.⁷⁸ A survey by the National Restaurant Association⁷⁹ found that 72% of the respondents were more likely to choose restaurants with healthy menu options. These findings were confirmed by a report from the Hudson Institute,⁸⁰ which found that between 2006 and 2011, sales of lower-calorie foods and beverages outperformed higher calorie items. Restaurants offering more low calorie items saw increased sales, growth in customer traffic and an increase in servings sold compared with restaurants selling fewer lower-calorie items. Customers offered reduced-portion sizes were willing to downsize their meals to

reduce calories.⁷⁷ Several restaurants attempted to offer reduced size menu items in the past with mixed results,⁸¹ however; recently several restaurant chains (Noodles and Co. and Pei Wei) have begun to offer both small and large menu portions.^{82,83}

Although the demand for lower calorie menu items could be met via reduced-portion items, limited research exists on the practicality of offering reduced-portion sizes of entrees in restaurant settings. A recent study⁸⁴ conducted structured interviews with 18 restaurant owners (representing over 350 restaurants) to determine interest in and ability to offer reduced size portions as part of a county wide voluntary recognition program. Owners noted that customer demand is central in menu planning and many did not feel that there was a demand among their customers for reduced size portions. Many were already offering multiple portion sizes for items such as soups, sandwiches, and salads, but only 8 offered reduced size entrees. Owners expressed concern regarding logistical challenges, additional training, increased costs associated with smaller sized products and reduced revenue. Recognizing these concerns, researchers noted that the program would be possible with technical assistance provided to restaurants to address challenges with food preparation and presentation. Despite the concerns of restaurant owners, offering reduced-portion sizes may be a more feasible option for locally-owned or independent restaurants than menu labeling, which one study found to be very time consuming and costly for independent restaurants.⁸⁵

To date no studies have examined the impact of offering reduced-portion menu items on restaurant logistics and costs, however 2 studies^{86,87} investigated the impact on restaurant sales with the addition of reduced size entrees to the menus. Both showed that consumers purchased the reduced size entrees, but sales of additional items differed between the studies. Vermeer et al. (2011)⁸⁶ introduced small portion sizes (roughly 2/3 of existing size) in addition to the regular-sized portions in 17 workplace cafeterias in the Netherlands. These were divided into two different conditions, proportional pricing or value-size pricing. An additional 8 cafeterias served as controls. Study participants (n=308) completed a series of questionnaires assessing demographic characteristics, and measuring eating behavior at specific times during the study. At the end, frequency of purchasing the reduced size entrees was measured and whether the participants ate more or less than usual when they purchased the reduced size entree. Findings showed that the proportion of small meal sales in relation to the large meal sales was around 10% regardless of pricing condition and were most often purchased by women. Sales of fried snacks were also measured to see if the consumers purchasing the reduced size entrees were compensating with additional food. Compensation was not observed, however survey data indicated that almost 20% of the individuals who purchased reduced size entrees often or always purchased additional food items.

An analysis was completed using sales data at a Midwest restaurant that introduced half portions in addition to the regular-sized portions for a 2-month

period.⁸⁷ Sales were compared to the same months of the previous year. Findings showed that while sales of the full size entrees decreased by 297 entrees, sales of half size entrees increased by 949 entrees. Sales of salads also increased by 116.5%, resulting in a net sales increase of almost \$7,000.

These limited studies suggest that reduced-portion sizes may be beneficial for restaurants as well as customers. Additional research is necessary to analyze the level of customer support for reduced size menu portions and the logistical and financial impact on restaurants choosing to offer reduced size portion items.

Food Waste

A recent report by the Natural Resources Defense Council (2012)⁸⁸ found that 40% of the food grown in the US is wasted. A similar report generated by the Food and Agriculture Organization (FAO)⁸⁹ of the United Nations found that globally about 1/3 of food produced is lost or wasted.

Food waste can occur at 5 different points throughout the supply chain including production losses at the farm level, losses in post-harvest handling and storage, processing and packaging losses, distribution and retail losses and consumer losses both at home and away from home.^{88,89} In less-developed countries, greater losses are found at the agricultural level, while in wealthier, more developed countries, such as the US, the greatest point of loss is at the consumer level.^{89,90}

Food waste impacts citizens on many levels. The US Environmental Protection Agency,⁹¹ notes that reducing the amount of food waste would produce significant social, economic and environmental benefits.

Nearly 49 million Americans are living in food insecure households.⁹² This represents 14.5 % of all households in America.⁹³ A study by Hall et al., 2009,⁹⁴ analyzed NHANES data and estimated that 150 trillion calories are lost annually. Gunders et al (2012)⁸⁸ used this estimate and calculated that reducing food losses by just 15 percent would result in enough food to feed more than 25 million Americans every year.

Food waste also results in wasted economic resources. Buzby et al. (2012)⁹⁵ utilized USDA ERS Loss Adjusted Food Availability data to estimate the amount and value of loss for over 200 foods. The calculated value of the food wasted in the US in 2008 retailed for \$165.6 billion dollars. This equates to a \$390 loss per person each year.

In addition to monetary losses, resources such as energy, water, fertilizer and pesticides, human labor and land are wasted. It is estimated that 25% of freshwater usage⁹⁵ and 300 million barrels of oil⁹⁴ are lost in the US in production of wasted food.

Additionally, food waste increases the production of greenhouse gases. In 2011, more than 36 million tons of food waste was generated, but only an estimated 4% was composted.⁹⁴ The remaining 96% was deposited in landfills.⁹⁴ Food waste is the largest component of municipal solid waste in the US and

when it decomposes in landfills, it produces about 34% of US methane emissions.⁹⁶ Methane has 21 times the global warming potential of carbon dioxide.⁹⁷

Reduced restaurant portion sizes – Food waste reduction

Large restaurant portion sizes have been identified as a key source of food waste in restaurants and other food service environments.⁸⁸ Restaurant diners leave around 17% of their meal uneaten and around 55% of these potential leftovers are thrown away.⁹⁸

Three years ago the National Restaurant Association joined with the Grocery Manufacturers Association and the Food Marketing Institute to form the Food Waste Reduction Alliance.⁹⁹ According to a study conducted by the FWRA to examine where waste is generated “post-agriculture to fork”, restaurants generate 37% of post-agricultural waste.¹⁰⁰ FWRA has developed 3 goals regarding food waste reduction based on the US Food Waste Recovery Hierarchy,⁹¹ which identifies the different levels of food waste reduction from the most preferred (source reduction) to the least preferred (incineration or landfill). Goal 1 is to lower the amount of food waste generated. Goal 2 is to increase the amount of food donated to individuals in need and goal 3 is to recycle unavoidable food waste rather than sending it to landfills.¹⁰⁰ LeanPath,¹⁰¹ a company designed to help food service organizations identify and eliminate waste, recommends reviewing portion sizes as the first step in reducing post-

consumer food waste in foodservice environments.¹⁰² While reducing portion sizes is recommended as a means to decrease waste, few studies have documented the amount of waste reduction obtained by reducing portion sizes in restaurant settings. Freedman et al. (2010)⁷⁶ showed that by reducing the portion size of French fries in a college cafeteria, waste of French fries decreased. The removal of trays from cafeterias has been shown to reduce both the amount of food selected and the amount wasted.¹⁰³ Thus, reduced portion sizes may help restaurants reduce the amount of food waste generated and decrease the amount of food waste needing to be recycled, but more research is needed to document the amount of waste reduction.

Summary

During the past 30 years as Americans have increased their consumption of FAFH. Concurrent with this is a rise in the obesity rate.^{6,7,8} Numerous studies have shown that FAFH is often high in calories and nutrients of concern, including total fat, saturated fat, cholesterol and sodium.^{19,20,21} Portion sizes of restaurant meals have also increased since the 1970's.²²

In the past few years, numerous regulatory approaches have been introduced to assist consumers in making healthier choices at restaurants.^{31,32,33,34} Recently, legislation requiring nationwide menu labeling has been passed.³⁰ While these nationwide laws have not yet been implemented, a number of cities and counties have passed menu-labeling laws.^{35,36,37} Although

one recent study has shown that consumers in these areas are utilizing the menu labels to make healthier menu choices,⁴⁰ results of studies examining the nutritional quality of purchases are mixed.^{41,42,43,44,45,46}

Studies in both laboratory-based settings and naturalistic settings have shown that increased portion sizes lead to increased energy consumption.^{52,53,54,55,56,57,58,59,61,62,63,64,65} A recent report also indicated that large restaurant portion sizes might lead to increased food waste.⁸⁸ Reduced restaurant portion sizes may be an effective means to decrease the intake of calories and nutrients of concern and decrease the amount of food wasted, however relatively few studies have examined the impact of reducing portion sizes in a restaurant setting.

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Chapter 2: Objective and Hypotheses

Objective

The primary objective of this study was to determine the impact of offering flexible portion-sized items in 2 food service environments on consumer acceptance, consumption, plate waste and business profitability.

Patterson Dental Hypotheses

1. Customers will select reduced-size portions and sales of reduced-portions will make up at least 10% of total entrée sales.
2. Consumption of reduced-portion size entrees will be associated with decreased intake of calories and selected nutrients as compared to baseline.
3. Consumption of reduced-portion size entrees will be associated with decreased plate waste.

TCC Hypotheses

1. Customers will select reduced-size portions and sales of reduced-portions will make up at least 10% of total entrée sales.
2. Consumption of reduced-portion size entrees will be associated with decreased intake of calories and selected nutrients as compared to consumption of full-size entrees during the post phase.

3. Consumption of reduced-portion size entrees will be associated with decreased plate waste.

Research Question

1. This study will explore the impact of offering reduced size portions on business profitability.

Chapter 3: Material and Methods

Overview

Methods and results will be presented separately for the 2 food service environments; Patterson Dental and the Town and Country Club in the Minneapolis/St. Paul metropolitan area. Patterson Dental is a business cafeteria that serves # employees. Roughly 125-200 employees dine in the cafeteria daily. Employees can choose from the entrée of the day, cold and hot sandwiches, soup or salad bar. Entrees, full sandwiches and the large salad bar are priced at \$3.00 per meal. The small salad bar, soup bowl and half sandwich are priced at \$1.50 each. Employees can pay by cash or can pre-purchase discounted meal tickets worth \$3.00 each. Reduced-sized entrees, priced at \$1.50, were introduced 5 weeks into the study and were available for all meals during the last 7 weeks of the study.

The Town and Country Club is a private golf club with over 500 members. Members pay an annual fee to join the club. To encourage members and their families to visit the club regularly, \$250 is credited to their account quarterly to cover dining expenses. This money is lost if the member does not use it within the quarter. Many members dine in the restaurant on a frequent basis. Each month the chef creates a new menu and includes a number of appetizers, desserts and entrees such as steaks, fish and pasta, which range in price from \$18 - \$32. Additionally, a monthly bar menu is created, which includes small

plates and appetizers, which range in price from \$7 – 15. Each time they dine, members receive both menus as well as a list of 2 or 3 daily specials. Prior to the intervention, reduced-size portions existed for a single entrée. The filet mignon had been available in 4 oz, 6 oz and 8 oz serving sizes for one year prior to the start of the study. During the intervention period, reduced-size portions of 5 additional entrees and 1 appetizer were added to the menu. The newly added reduced-size entrees were priced at \$15-\$17 and the appetizer at \$5.

Patterson Dental Materials and Methods

Planning/Schedule

Prior to the start of the study, researchers regularly met with the cafeteria manager to provide a study overview and discuss the introduction of reduced-portion sized entrees, survey development, protocols and plate waste data collection. A plate waste data collection schedule was set up to include a variety of different types of entrees served. It was intended to include identical entrees served in both the pre and post-phase of the study. Due to menu changes that occurred throughout the study, only 6 entrees were available in both the pre-phase and the post-phase of the study. All entrees during the post-intervention period were available in both the full and reduced-portion sizes.

Subjects

Survey and food consumption data were collected from Patterson Dental employees (>18 years) from April to July 2013. Employees were asked to complete an online survey prior to collection of baseline food consumption data and at the end of the study to collect information on patronage, cafeteria satisfaction, menu items ordered and the health consciousness of the employees. Plate waste data were collected from employees who purchased lunch in the employee cafeteria. No compensation was provided for participation. The University of Minnesota Institutional Review Board reviewed this study and confirmed that the study met the criteria for exempt status, category 2: surveys/interviews, observation of public behavior.

Experimental Schedule

Invitations to complete the survey were sent via internal e-mail from the cafeteria manager to all employees prior to collecting baseline food consumption data and at the end of the study. Plate waste and consumption data were collected over the course of 12 weeks. (Table 1) Baseline data were collected over 5 weeks prior to the introduction of the reduced-size entrée items. Experimental data were collected over an additional 7 weeks after the introduction of the reduced-sized entrée. Sales data were collected for all days within the 12-week period.

Surveys

Surveys were created by a marketing consultant on the research team, who has worked extensively as a marketer in the packaged foods and food service industry. Survey questions were developed through a series of meetings with the kitchen manager and the research team. Learning objectives were developed, which guided the question development. The research team reviewed each survey and any necessary adjustments were made. The Patterson Dental human resources department then reviewed and approved the surveys. Upon final approval, the surveys were sent via internal email by the cafeteria manager with an invitation and a consent form from the University of Minnesota to all on-site employees prior to the start of baseline data collection and at the completion of the study.

The first survey (Appendix 1) assessed age and gender, frequency of cafeteria use, cafeteria satisfaction, purchasing history, menu item satisfaction, the importance of cafeteria menu attributes and frequency of healthful behaviors. The second survey (Appendix 2) included the same questions, but also included the half-size entrée as a menu item selection.

Customers were asked to note their age range and gender. Frequency of cafeteria use was determined by having participants choose between 0 and 10 for how many days they purchased lunch at the cafeteria during the past 2 weeks. To assess cafeteria satisfaction, participants were asked to rate a number of cafeteria qualities on a scale from 1 (not at all satisfied) to 5

(completely satisfied). Customers were also asked to indicate which menu items they purchased during the past 2 weeks and check the number of times they purchased that menu item on a scale of 1 to 10. Customers were also asked to rate satisfaction of their purchases during the past 2 weeks on a scale of 1 (not at all satisfied) to 5 (completely satisfied). They were asked if they noticed any changes in the foods offered in the previous 2 weeks and if so to specify. They were asked to rate on a scale of 1 (not important at all) to 5 (extremely important) a number of possible needs, such as convenience and price, with respect to how important the needs are at lunch. Lastly, participants were asked to rate how often they follow a number of healthful behaviors on a scale of 1 (never) to 5 (always).

Plate Waste Collection Protocol

Prior to the start of the study, the research team met with the cafeteria manager on multiple occasions to discuss the study and set up a data collection protocol. Before baseline data collection, the plate waste data collection protocol was pilot tested on April 4, 2013. During this pilot day, standard portion sizes of the entrée were served. Plate waste was collected for all employees dining in the cafeteria. As inefficiencies were identified in the protocol, modifications were made to the original procedure. The modified data collection protocol (Appendix 3) was used to train 4 undergraduate research assistants prior to assisting with data collection. Additional training was given at the cafeteria by the primary

researcher, who was onsite on all plate waste measurement days. The researchers consistently used the data collection protocol throughout this study.

Plates:

All menu items were served on standardized paper or Styrofoam plates. Different plates and bowls were used for each menu item including large and reduced-entrees, full and half sandwiches and full and half salads. Full-sized entrées were served on a three-section Styrofoam plate; large sandwiches on a one section Styrofoam plate; large salads on a large green patterned paper plate. Half-size sandwiches and salads were served on small paper plates with distinctly different patterns and when introduced, the half-sized entrees were served on smaller 3 section paper plates. Fifteen samples of each plate type were weighed and averaged to establish uniform mean plate weights.

Plates were pre-counted prior to the lunch service and were handed out by staff as meals were purchased. The remaining plates were recounted at the completion of the lunch service to determine the number of each menu item sold.

Average Serving Sizes

Standardized serving utensils were used to dish each menu item to ensure consistent serving sizes. To establish the serving weights for each entrée component, 15 samples of each item were weighed and recorded on a serving weight data collection form (Appendix 4). Mean serving sizes were calculated for

each entrée item. Cold sides were not pre-plated so customers could choose their own portion size, therefore cold sides were not included in this analysis.

Signage

With the introduction of reduced-size portions, a sign identifying the reduced-portion size entrée and price was placed at the hot food station with a plated reduced-portion entrée. This was done to inform employees that the reduced-portion size entrees were available and to display the difference in size from the usual full servings.

Lunch process

Employees entered the cafeteria from a single entrance. Prior to entering the cafeteria, employees collected silverware, napkins, trays and a beverage. Coffee, tea and water were available free of charge. Sodas were available for purchase via vending machines. Once the employees entered the cafeteria, they proceeded through the tray line. Two stations were set up in the cafeteria line – one for hot foods and the other for cold or hot sandwiches. Employees who chose the salad bar also went to the sandwich station to obtain a salad bar plate from the cafeteria staff. They then proceeded to the self-serve salad bar to make their salad selections. Once employees ordered their food, they paid at the cash register either by cash or by pre-paid meal ticket. For certain meals, hot foods were plated at the cafeteria line and cold food, such as a side salad, were

available in a separate self-serve line. Once customers received their hot food and paid for their meal, they proceeded to the self-serve line to dish their cold sides.

At the completion of lunch, all food and paper waste and recyclables were brought to a single waste station. Silverware and glasses were placed on a nearby counter at the dishwashing station.

Waste Collection

Throughout the lunch service a research assistant was positioned at the waste station. The researcher collected all plates and bowls including waste for each employee and placed them on a rolling cart stationed at the waste collection area. Multiple plates from one employee were stacked to ensure they were recorded together. Cracker and condiment wrappers were kept on plates to account for intake.

Plate Waste Measurement

The primary researcher was stationed in the back of the kitchen at a weight station. Plates and food waste area were transferred from the waste collection area via a rolling cart to the weigh station. At the weigh station, two digital scales were tared to zero. Plate waste was determined by weighing each plate collected. Plate waste measurements were recorded on a data collection record sheet. (Appendix 5) If a plate appeared empty, plate waste was recorded

as zero. If waste was present on the plate, the plate was weighed initially and that weight was recorded. Any remaining entrée waste was removed from the plate and the plate was weighed a second time with only the starch and vegetable remaining. This was recorded as sides only. If a starch was present, it was removed and the plate was weighed a third time and the vegetable only weight was recorded.

The amount wasted for each of the menu components was calculated as such:

Total Plate Waste Weight – Sides only = Main entrée waste

Sides only – Vegetable only = Starch waste

Vegetable only – Plate weight = Vegetable waste

Determining Plate Waste – Special Considerations

Any peels, bones or parts of food not normally consumed that remained on the plate were removed and not included in the plate waste calculations. Condiments such as ketchup or mustard that were not part of the served entrée were wiped from the plate or food items were removed from the condiment-filled plate and placed on an empty plate for weighing. Food items, such as French fries, covered in condiments were wiped to remove condiments.

Amount Consumed

The amount consumed for each employee was determined by subtracting the plate waste of a particular item from the average serving weight. For example, if the average serving size of lasagna is 250 g and the plate waste for a particular sample of lasagna is 30 g, then $250\text{g} - 30\text{g} = 220\text{g}$ consumed. Plate waste was calculated for each meal component on the plate.

Nutritional Analysis

Recipes were obtained from the Cafeteria Manager and were entered into the Nutrition Data System for Research, NDSR ©2013. Nutritional analysis was done to identify the energy and nutrient content of the served portion. (Table 2) Nutrients analyzed included key nutrients of concern linked to obesity and other chronic diseases, such as fat, saturated fat, cholesterol and sodium. Other nutrients analyzed included common shortfall nutrients, such as calcium, fiber, and potassium and iron.¹⁰⁴ Analysis was conducted for each plated menu item based on mean serving weight, which was calculated from 15 sample weights of each menu item.

Management Interview

The primary researcher and the marketing consultant interviewed the cafeteria manager after the completion of the study. Interview questions were developed by the business consultant to assess the process of adding reduced-

portion sizes to the menu. (Appendix 6) Questions asked about any challenges the cafeteria faced adding the reduced-portion sizes, customer feedback, and the impact on their business operations. Interviews were transcribed, reviewed, and summarized by the marketing consultant

Statistical analysis

All data were analyzed using SAS version 9.3 or 9.4 (Cary, NC), with comparisons made at $\alpha = 0.05$. Test of equal proportions were conducted for each menu item to determine if there were an equal proportion of customers purchasing the entrée during the pre and post phase. This was done to ensure that the individuals choosing the half portion items were individuals who had previously purchased the full size entrée.

The tests of equal proportions (Table 3) yielded 5 menu entrees with a relatively equal number of employees purchasing the entrée in the pre condition when only the full portion was available (pre-phase) and the post condition where both the full and reduced size entrée were available (post-phase). One entrée, the Chicken Parmesan, had a significantly greater proportion ($p = 0.028$) of employees purchase the entrée in the post-phase when compared to the pre-phase. Therefore, it is not included in the calorie and nutrient analysis.

T-tests were performed to determine the difference between energy consumption, nutrient intake and food waste for the aggregate of the 5 meals offered during the pre phase and the aggregate of the 5 meals offered during the

post phase of the study. Chi – squared tests were performed to determine the difference between the demographics of pre survey participants and post survey participants. Chi squared tests were also performed to determine demographic differences between reduced-portion buyers and non-buyers and to determine differences in survey data between reduced-portion buyers and non-buyers.

Table 1 Patterson Dental plate waste collection schedule

Condition	Date*	Day of Week	Entrée Served
Pre - Only Full Size Entrees Available	4/4/13	Thurs.	Meatloaf, Scalloped Potatoes, Green Beans
	4/9/13	Tues.	Spaghetti with Meat Sauce, Side Salad
	4/16/13	Tues.	Pork Loin, Mac and Cheese, Asparagus
	5/2/13	Thurs.	Chicken or Vegetable Lasagna, Side Salad
	5/3/13	Fri.	Chopped Steak, Mashed Potatoes, Veggies
Post - Full and Half Size Entrees Available	5/8/13	Wed.	Meatloaf, Scalloped Potatoes, Green Beans
	5/13/13	Mon.	Spaghetti with Meat Sauce, Side Salad
	5/20/13	Mon.	Pork Loin, Mac and Cheese, Asparagus
	6/5/13	Wed.	Chicken or Vegetable Lasagna, Side Salad
	6/6/13	Thurs.	Chopped Steak, Mashed Potatoes, Veggies

*Data collected on additional days, but dates where pre and post plate waste data were available and met test of equal proportions were listed.

Table 2 Patterson Dental nutritional content of mean full and half portion entrée serving size*

Entrée F = Full size H = Half size	Kcal	Fat (g)	Chol (mg)	Na (mg)	Sat FA (g)	Fiber (g)	Ca (mg)	K (mg)	Fe (mg)
Pork Loin F	579	29.9	137	752	13	3.5	335	824	3.5
Pork Loin H	306	10.5	75	414	7.2	1.9	190	430	1.8
Chopped Steak F	646	40.9	167	1405	19	4.7	168	1157	6
Chopped Steak H	322	20.6	81	685	9.8	2.4	83	565	3.1
Lasagna F	551	34.4	118	806	21.6	3.2	511	308	1.8
Lasagna H	262	16	53	363	9.7	1.4	230	138	0.8
Meatloaf F	707	42.7	236	599	18.6	6.3	271	1228	6.5
Meatloaf H	342	21.5	116	312	9.6	3.3	143	642	3.3
Spaghetti F	675	23.7	66	1208	7.9	6.4	73	795	5.8
Spaghetti H	377	13.7	39	689	4.6	3.5	42	459	3.3

*Based on collection day when both sizes were both entrée sizes were available

Table 3 Patterson Dental test of equal proportions

Entree	Entrée/ Total	Proportion Full Only	Entrée/ Total	Proportion Full & Half	P-Value
Meatloaf	111/157	0.707	104/166	0.627	0.125
Spaghetti	106/189	0.561	136/215	0.632	0.142
Pork Loin	103/173	0.595	131/210	0.624	0.570
Lasagna	113/180	0.628	132/203	0.650	0.647
Chopped Steak	117/170	0.688	124/191	0.649	0.432
Ckn. Parmesan	109/192	0.634	155/210	0.738	0.028*

* Significant at $P < 0.05$

Town and Country Club Materials and Methods

Planning/Schedule

Prior to the start of the study, the researchers met with the chef and assistant club manager on numerous occasions to discuss the different aspects of the study including which menu items to offer in reduced-portions, survey development, plate waste collection protocols and to set up a schedule for plate waste data collection. All entrees with the exception of the vegetarian option were available in full and reduced sizes during the post-intervention period. Data collection days were set up for Thursday, Friday and Saturday, as entrée sales were higher on these days.

Subjects

Survey and food consumption data were collected from Town and Country Club members (>18 years) from April to June 2013. Only club members who completed a survey questionnaire or purchased dinner in the restaurant on data collection days were included in the study. Members were asked to complete an online survey prior to collection of baseline food consumption data and at the end of the study to assess purchases in the past 3 weeks, the likelihood of ordering in the next 3 weeks and participation in healthy behaviors. Plate waste data were collected from all diners at a table, where at least one person ordered one of the test menu items. No compensation was provided for participation. The University of Minnesota Institutional Review Board reviewed this study and confirmed that

the study met the criteria for exempt status, category 2: surveys/interviews, observation of public behavior.

Experimental Schedule

Surveys invitations were sent via internal e-mail from the club manager to all club members prior to collecting baseline food consumption data and at the end of the study. Plate waste and consumption data were collected on Thursdays, Fridays and Saturdays over the course of 7 weeks. Three weeks of baseline data were collected prior to the introduction of the reduced-size entrées. Plate waste data were collected for an additional 4 weeks after the introduction of the reduced-sized entrées. Sales data were collected for all days within the 7-week period.

Surveys

Surveys were developed by a marketing consultant on the research team, who has worked extensively as a marketer in the packaged foods and food service industry. Survey questions were developed through a series of meetings with the chef and assistant club manager and the research team. Learning objectives were developed, which guided the development of survey questions. The research team reviewed each survey and any necessary adjustments were made. The Club membership committee and management then reviewed and approved the surveys. Once final approval was obtained from all parties, the surveys were sent via internal e-mail from the cafeteria manager to all on-site

employees prior to the start of baseline data collection and at the completion of the study.

Invitations to complete an online survey were sent by club management to all club members prior to the start of baseline data collection and at the completion of the study. The first survey (Appendix 7) collected data on age range and gender, purchases during the previous 3 weeks, likelihood of purchasing full and reduced-size menu items in the next 3 weeks, and frequency of healthful behaviors. The second survey (Appendix 8) included the same questions, but also included the half-size entrée as menu item selections for both the past 3 weeks and the next 3 weeks.

Survey participants indicated which menu items they purchased in the past 3 weeks by checking 1 of 3 choices: have not purchased, not sure or have purchased. Likelihood of purchasing specific menu items in the upcoming 3 weeks was indicated by checking 1 of 5 choices ranging from “definitely would not buy” to “definitely would buy”. Lastly, participants were asked to rate how often they follow a number of healthy behaviors on a scale of 1 (never) to 5 (always).

Plate Waste Collection Protocol

Prior to the start of the study, the research team met with the chef and assistant club manager on multiple occasions to discuss the study and develop a plate waste collection protocol. Before baseline data were collected, a pilot day

occurred on April 12, 2013. During this pilot day, standard portion sizes of the entrée were served. Plate waste data were collected for members dining in the restaurant. As inefficiencies were identified in the protocol, modifications were made to the original procedure. The modified data collection protocol was used to train 4 undergraduate research assistants prior to assisting with data collection. Additional training was given at the restaurant by the primary researcher, who was onsite and working alongside research assistants on all but the last 3 plate waste measurement days. Researchers consistently used the data collection protocol throughout this study.

Meal Process

As members entered the restaurant they were seated in one of three dining rooms; a formal dining room, a bar room with counter seating as well as booths and tables, or a more casual dining area. Each member received 2 menus, a bar menu containing appetizers and more casual items and an entrée menu containing the main entrees, salads and desserts. All diners could choose items from either menu. When additional reduced-portion size menu items were introduced, updated menus were printed. These updated menus replaced the previous menus and included both the full and the reduced-portion size items on the menu.

After diners placed their orders with their server, the server went to the drink station, a separate room off of the kitchen to pour drinks for service at the table. In the same room, servers also prepared a breadbasket for the table. Bread was kept in warming drawers and each server individually cut a set number of pieces for each table, based on the number of diners. Servers then delivered drinks and the breadbasket to the table. After meals were prepared and assembled, the server delivered the plates to the table.

At the end of the meal, plates were collected from the dining areas by either the server or staff clearing tables and brought to the dishwashing area. Food and paper waste were thrown away and empty plates, glasses and silverware were placed on the dishwashing counter to be washed.

Data collection

Table number and customer demographic information were collected from servers as each table was seated and recorded by the researchers on a data collection sheet (Appendix 9). Information provided included the table number, number of diners in the party, gender and estimated age range. Information was collected for all tables where at least one diner ordered one of the test items. Plate waste measurements for all diners at the table over 18 were also recorded on the same data collection sheet.

Waste Collection

A weigh station was set up between the prep station and the dishwashing station. On each data collection day, at least 2 researchers were present to weigh plate waste. As plates were collected at the end of the meal and brought to the dishwashing area, researchers collected the plates and waste prior to being emptied. Table numbers and meal information was obtained from the server or staff clearing tables and were recorded on the data collection sheet for each plate.

Plate Waste Measurement

Prior to delivery to the customer, the full plate of food was weighed. The pre-weight was recorded and table number and customer demographic data were obtained from the server and recorded.

At the completion of the meal, the finished plates were collected from the table and brought directly to the researchers. Plates were weighed and final weight was recorded. The scale was tared to the weight of an empty cardboard boat. Each menu component was placed in a boat and weighed separately. Waste weights for each of the menu components were recorded.

Amount Consumed

The amount consumed for each diner was determined by subtracting the plate waste of a particular item from the average serving weight. For example, if

the average serving size of halibut is 200 g and the plate waste for a particular sample of halibut is 30 g, then $200\text{g} - 30\text{g} = 170\text{ g}$ consumed. Consumption amounts for each of the meal components were then added to give a total consumption amount. Plate waste for each meal component was added to give a total waste amount.

Nutritional Analysis

Recipes were obtained from the Chef and were entered into the Nutrition Data System for Research, NDSR ©2013. Nutritional analysis was used to identify the energy and nutrient content of the served portion. (Table 5) Nutrients analyzed included key nutrients of concern linked to obesity and chronic disease, such as fat, saturated fat, cholesterol and sodium. Other nutrients analyzed included common shortfall nutrients, such as calcium, fiber, potassium and iron. Analysis was conducted for each plated menu item based on mean serving weight, calculated from 15 sample weights.

Nutritional Analysis – Special Considerations

It was not possible to calculate the nutrient content of the red wine reduction sauce with NDSR, therefore researchers consulted with a Chef who is also Registered Dietitian. Based on his recommendations, the nutrient content was calculated in NDSR for the full 2 cup serving size based on the TCC chef's

recipe and the calories attributed to the alcohol were subtracted. This procedure was used because reducing the red wine burns off the alcohol.

Management Team Interview

The Chef and Assistant Country Club Manager were interviewed after the completion of the study by the primary researcher and business consultant. Interview questions were developed by the business consultant to assess the process of adding reduced-portion sizes to the menu. (Figure 6) Questions were asked about any challenges the cafeteria faced when adding the reduced-portion sizes, customer feedback, and the impact on business operations. Interview transcripts were reviewed by the consultant and summarized.

Statistical Analysis

All data were analyzed using SAS version 9.3 or 9.4 (Cary, NC), with comparisons made at $\alpha = 0.05$. T-tests were performed to determine the difference between energy consumption, nutrient intake and food waste for the 7 reduced-portion entrees (half halibut, half salmon, half walleye, half lamb, 6 oz. strip steak, 4 oz. filet mignon and 6 oz. filet mignon) and the 6 full-sized entrees (halibut, salmon, walleye, lamb, 12 oz. strip steak and 8 oz. filet mignon) offered during the post phase of the study. Chi – squared tests were performed to determine the difference between the demographic characteristics of pre survey participants and post survey participants. Chi squared tests were also performed

to determine differences in demographic characteristics between reduced-portion buyers and non-buyers and to determine differences in survey responses between reduced-portion buyers and non-buyers.

Table 4 – TCC entrée components*

Meat	Vegetable	Starch
Filet Mignon	Spring Vegetables	Roasted New Potatoes
Strip Steak	Asparagus	Caramelized Onion Mashed Potatoes
Halibut	Spring Vegetables	Roasted New Potatoes
Walleye	Carrot Batons	Spring Vegetable Risotto
Salmon	Garlic Spinach	Spring Vegetable Risotto
Lamb Chops	Smashed Peas	Spring Vegetable Risotto

Table 5 TCC nutritional content of mean full and half portion entrée serving size including sides

Entrée	Kcal	Fat (g)	Chol (mg)	Na (mg)	Sat FA (g)	Fiber (g)	Ca ²⁺ (mg)	K (mg)	Fe (mg)
F = Full Portion									
H = Half Portion									
Halibut F	647	37.9	171	1647	20.1	5.5	71	1850	2.7
Halibut H	301	18.3	78	777	9.8	2.6	33	830	1.3
Walleye F	963	55.3	375	1590	32.7	4.7	372	1583	8.4
Walleye H	517	29.9	192	987	17.3	2.6	189	814	4.3
Salmon F	612	27.9	148	1679	11.3	4.1	200	1620	6
Salmon H	320	14.2	69	929	6.2	2.4	113	793	3.2
Lamb Chops F	1308	102.5	139	1049	23.5	10	124	1195	6.2
Lamb Chops H	692	43.5	73	652	12.5	5.5	65.5	629	3.3
Strip Steak F	1189	74.9	321	2411	35.3	7.2	220	1934	7.7
Strip Steak H	600	37.8	161	1219	17.9	3.7	112	1090	3.9
4 oz. Filet	363	18.9	96	999	9.1	2.3	45	944	4.0
6 oz. Filet	653	35.3	160	1924	17.5	4.9	78	1671	6.5
8 oz. Filet	746	38.9	196	2078	18.8	4.9	92	1968	8.2

Chapter 4: Results

Patterson Results

Nutrient Intake and Plate Waste

Calorie and nutrient intakes, summarized in Table 6, were significantly lower for the combined 5 entrees during the post-phase when both full and half size entrees were served compared to the pre-phase. The number of calories consumed decreased from a mean of 695 during the pre-phase period to 555 during the post-phase period ($p < 0.0001$). Nutrients of concern, including total fat, saturated fat, cholesterol and sodium were also significantly lower during the post-phase period (all at $p < 0.0001$). In addition to the decreased intake of nutrients of concern, decreased intakes of shortfall nutrients, such as fiber, calcium, potassium and iron, were also observed (all at $p < 0.0001$, except for potassium at $p < 0.0005$).

A significant decrease in plate waste was also observed during the post-phase. Plate waste decreased from 45.5 g in the pre-phase to 29.7 g in the post phase ($p < 0.0001$).

Sales

Sales of reduced-portion entrees were lowest (5.3% of total entrée sales) during the first week they were whereas sales were greater than 10% in several subsequent weeks (Table 7). According to the cafeteria manager, some

confusion may have existed among cafeteria patrons regarding the use of pre-paid meal tickets to pay for reduced-portion size entrees during the first week they were offered. . Sales of reduced-portion entrees increased during the next 5 weeks ranging from 8.2% to 12.8% of weekly entrée sales.

Demographic Characteristics of Survey Participants

Survey participant demographic data by pre- and post-phase are summarized in Table 8. No significant differences were observed in participants' gender. The initial survey included 25 men and 25 women and the final survey included 22 men and 19 women ($p=0.728$). The majority of participants for both surveys were equally distributed between the age ranges of 25 to 34 and 55 to 64 years. No significant differences were found between the ages of the survey participants by pre- versus post-phase ($p=0.850$).

Post-phase surveys were also analyzed to determine if there were any differences in demographic characteristics between the individuals who indicated they purchased a reduced-portion entrée and those who indicated they did not purchase a reduced-portion entrée. (Table 9) No significant differences were observed for age ($p=0.890$) or gender ($p=0.322$).

Survey Responses

The post-phase survey response rate was between 33-50%. Responses were analyzed to determine whether responses differed between individuals who

indicated that they purchased the reduced-portion entrees and those who did not. (Table 10) Responses to the question regarding the importance of certain needs at lunch were pooled for those who responded with a 4 or 5 on a scale from 1 (not at all satisfied) to 5 (completely satisfied). No significant differences were observed between the reduced-portion purchasers (half-portion buyers) and non-purchasers (non-buyers) on convenience/accessibility ($p=0.361$), quality of food/taste appeal ($p=0.832$), price/value ($p=0.345$), appetite satisfaction ($p=1.000$), and environmental impact ($p=0.175$). Most (92.9%) respondents who were half-portion buyers indicated that they were satisfied regarding the health/nutrition of cafeteria options compared to non-buyers where only 69.4% indicated they were satisfied ($p=0.081$).

Participants were asked how often they participated in a variety of healthful behaviors with responses of “most of the time” or “always” pooled. No significant difference were found between the reduced-portion purchasers and non-purchasers on how often they indicated they eat balanced meals ($p=0.114$), eat more fruit, vegetables and/or whole grain foods ($p=0.363$), limit portion sizes to avoid overeating ($p=0.860$), avoid fat, cholesterol, salt, and/or sugar ($p=0.278$), exercise vigorously multiple times each week (0.723), walk/take the stairs as often as I can ($p=0.412$), follow a diet to lose weight ($p=0.243$), watch intake of certain foods because of a health condition ($p=0.345$) and watch food intake to manage weight ($p=0.278$).

Summary of Interview Results

The Cafeteria Manager felt that the addition of the reduced-size portions was successful for selected entrees, both from a financial standpoint and from a customer satisfaction standpoint. The manager indicated that the Patterson cafeteria, a company-subsidized operation, observed reductions in costs. Offering reduced-size portions allowed for preparation of less food, knowing that a portion of their employees may choose the reduced-portion; thereby reducing costs as well as waste. According to the manager, customer feedback indicated that they enjoyed the addition of reduced-size entrées as it provided them with greater flexibility to reduce intake or choose to pair a reduced-size entrée portion with other menu items, such as a side salad or a bowl of soup. Based on observations, the manager felt that the reduced-portion entrees appealed to employees, who were more health conscious at all ages and women in particular. The cafeteria continued to offer reduced-portion-sizes for select entrees after the completion of the study.

Table 6 Patterson Dental calorie and nutrient intake by pre-phase (only full portions available) and post-phase (full and reduced-portions available)

	Pre-Phase Mean (SE) (n=521)	Post-Phase Mean (SE) (n=603)	P value¹
Nutrient			
Calories	629 (4)	555 (5)	<0.0001
Fat (g)	34 (0.4)	29.7 (0.4)	<0.0001
Saturated Fat (g)	16.1 (0.2)	13.9 (0.2)	<0.0001
Cholesterol (mg)	141 (2.4)	122 (2.3)	<0.0001
Na (mg)	955 (13)	849 (13)	<0.0001
Fiber (g)	4.6 (0.1)	4.1 (0.7)	<0.0001
Calcium (mg)	291 (8.4)	238 (6.1)	<0.0001
Potassium (mg)	796 (13.8)	728 (13.4)	<0.0005
Iron (mg)	4.4 (0.1)	4.0 (0.1)	<0.0001

¹P-value for differences in nutrient intakes between pre-phase (only full size available) and post-phase (full and half size available) according to T- tests (P<0.05).

Table 7 Patterson Dental percent reduced-portion entrée sales by week

	Total Entrée Sales	Total Reduced- portion Sales	% Reduced- portion Sales
Week 1 Post	569	30	5.3
Week 2 Post	519	60	11.6
Week 3 Post	633	81	12.8
Week 4 Post	436	36	8.3
Week 5 Post	746	61	8.2
Week 6 Post	603	65	10.8

Source: Cafeteria Sales Reports

Table 8 Patterson Dental demographic characteristics for respondents by survey phase

	Pre-Phase Survey (n=54)	Post-Phase Survey (n=50)	P-value¹
Age	# (%)	# (%)	0.850
<25 years old	2 (3.8)	4 (8.0)	
25-34 years old	12 (22.6)	11 (22)	
35-44 years old	13 (24.5)	11 (22)	
45-54 years old	12 (22.6)	13 (26)	
55-64 years old	13 (24.5)	11 (22)	
65 years or older	1 (1.9)	0 (0)	
Gender			0.728
Female	25 (50)	19 (46.3)	
Male	25 (50)	22 (53.7)	

¹P-value for differences between demographic characteristics for those responding to the pre-phase versus post-phase survey, according to chi square tests (P<0.05).

Table 9 Patterson Dental demographic characteristics for post survey respondents by half portion buyer or non-buyer

	Half Portion Buyers (n=14)	Non-Half Portion Buyers (n=36)	P-value¹
Age	n (%)	n (%)	0.890
<25 years old	2 (14.3)	2 (5.6)	
25-34 years old	3 (21.4)	8 (22.2)	
35-44 years old	3 (21.4)	8 (22.2)	
45-54 years old	3 (21.4)	10 (27.8)	
55-64 years old	3 (21.4)	8 (22.2)	
65 years or older	0 (0)	0 (0)	
Gender			0.322
Female	7 (58.3)	12 (41.4)	
Male	5 (41.7)	17 (58.6)	

¹P-value for differences in demographic characteristics between half portion buyers and non-buyers by pre- and post-phase, according to chi square tests (P<0.05).

Table 10 Patterson Dental – post-phase survey responses by half portion buyer or non-buyer

	Half Portion Buyer (n=14) n (%)	Half Portion Non-Buyer (n=35) n (%)	P-value¹
Importance of Needs at Lunch	Participants who chose “4” or “5” on a scale from 1 (not at all satisfied) to 5 (completely satisfied)		
Convenience/Accessibility	14 (100)	33 (94.3)	0.361
Quality of Food/Taste Appeal	13 (92.9)	34 (94.4)	0.832
Price/Value	11 (78.6)	32 (88.9)	0.345
Appetite Satisfaction	12 (85.7)	30 (85.7)	1.000
Health/Nutrition	13 (92.9)	25 (69.4)	0.081
Environmental Impact	9 (64.3)	15 (42.9)	0.175
Healthful Behaviors: How often do you...	Participants who chose “most of the time” or “always”		
Eat balanced meals	13 (92.9)	26 (72.2)	0.114
Eat more fruit, vegetables and/or whole grain foods	9 (64.3)	18 (50)	0.363
Limit portion sizes to avoid overeating	7 (50)	19 (52.8)	0.860
Avoid fat, cholesterol, salt and/or sugar	9 (64.3)	17 (47.2)	0.278
Exercise vigorously multiple times each week	7 (50)	16 (44.4)	0.723
Walk/take the stairs as often as I can	12 (85.7)	27 (75)	0.412
Follow a diet to lose weight	4 (28.6)	5 (14.3)	0.243
Watch my intake of certain foods because I have a specific health condition	4 (28.6)	6 (16.7)	0.345
Watch my food intake to manage my weight	9 (64.29)	17 (47.2)	0.278

¹P-value for differences in healthful behavior survey responses between full and reduced size purchasers according to T- tests (P<0.05).

TCC Results

Nutrient Intake and Plate Waste

Calorie and nutrient intakes were compared for individuals who purchased full size entrées (n=90) and those who purchased a reduced size entrée (n=95) during the post-phase of the study. (Table 11) The number of calories consumed was significantly reduced for those who purchased a reduced-portion entrée compared to those who purchased a full-size entree. Calories consumed decreased from a mean of 695 to 393 ($p<0.0001$). Nutrients of concern, including total fat, saturated fat, cholesterol and sodium all decreased significantly compared to those who purchased a full-portion entree. In addition to the decreased intake of nutrients of concern, decreased intakes of shortfall nutrients, such as fiber, calcium, potassium and iron, were observed between groups.

Plate waste was also reduced for the group that purchased the reduced-size entrees compared to full-size entrée purchasers. Plate waste decreased from a mean of 2.7 oz. for full-size entrée purchasers to 1.6 oz. for reduced-size purchasers ($p<0.0051$).

Sales

During the pre-phase of the study, only one entrée, filet mignon, was available in multiple portion sizes; 4 oz., 6 oz., and 8 oz. Sales of the 4 oz. and 6 oz. filet mignon, made up between 6.0 and 13.3 percent of total weekly entrée

sales. (Table 12) The introduction of 5 additional reduced-portion entrees, increased the percentage of total entrée sales attributable to reduced-portion entrees to 31.3% the week of the introduction, 18.8% the second week post introduction and 26.0% and 29.4% the following weeks.

Demographic Characteristics of Survey Participants

Survey participant demographic data by study phase are summarized in Table 13. No significant differences were observed for participant's gender. The initial survey included 87 men and 109 women and the final survey included 48 men and 76 women ($p=0.32$). Participants of both surveys ranged in age from 25 to over 65 years. No significant differences were found between the ages of the survey participants for both phases ($p=0.94$).

Post-phase survey data were also analyzed to determine if there were any differences in demographic characteristics between the individuals who indicated they purchased a reduced-portion entrée and those who indicated that they did not purchase a reduced-portion entrée. (Table 14) No significant differences in age ($p=0.70$) or gender ($p=0.29$) were found.

Survey Responses

Survey data were also analyzed regarding responses to the question asking about how often participants engaged in healthful behaviors. (Table 15) Responses of "most of the time" or "always" were pooled. No significant

difference were found between the reduced-portion purchasers and non-purchasers for how often they indicated they eat balanced meals ($p=0.609$), eat more fruit, vegetables and/or whole grain foods ($p=0.748$), avoid fat, cholesterol, salt, and/or sugar ($p=0.160$), exercise vigorously multiple times each week (0.080), walk/take the stairs as often as I can ($p=0.234$), follow a diet to lose weight ($p=0.695$), and watch food intake to manage weight ($p=0.644$).

Significant differences were observed for those who indicated that they limit portion sizes to avoid overeating by reduced-portion purchasers versus non-reduced-portion purchasers. More than 86% of individuals who indicated they purchased a reduced size entrée said they limit portion sizes “most of the time” or always compared to 71% of non-purchasers ($p=0.037$). Significant differences were also seen between those who indicated that they watch their intake of certain foods because of a specific health condition. Roughly 41% of the non-purchasers selected “most of the time” or “always” compared to only 13.6% of the reduced-size purchasers ($p=0.022$).

Summary of Interview Results

Although some initial challenges were experienced from staff getting used to the introduction of reduced-size portions, both the Chef and Assistant Club Manager felt the addition of reduced-portion entrees was successful, both financially and based on feedback from their members. According to the Chef “we are making 55-60% of the price of a full portion...and when you sell items at

a higher margin, you can't lose on that." They indicated that they had received positive feedback from customers regarding the addition of the reduced-portion entrees to the menu. The club's dining committee, made up of club members has asked the club to continue offering reduced-portion sizes. The Chef felt that the reduced-portions appealed to 2 different segments of their membership, older members and younger members, who ate at the club multiple times per week.

Table 11 TCC calorie and nutrient intake by full and reduced size portion for entrees purchased in post phase*

	Full Size (n=90) Mean (SE)	Reduced Size (n=95) Mean (SE)	P-value¹
Nutrient			
Calories	695 (24.4)	393 (14.3)	<0.0001
Fat (g)	40.3 (2.1)	21.8 (0.9)	<0.0001
Saturated Fat (g)	18.4 (0.9)	10.9 (0.5)	<0.0001
Cholesterol	187 (9.3)	108 (4.7)	<0.0001
Na (mg)	1,396 (43)	934 (42.2)	<0.0001
Fiber	4.4 (0.2)	2.6 (0.1)	<0.0001
Calcium (mg)	168 (11.3)	82 (5.5)	<0.0001
Potassium (mg)	1,397 (38.6)	863 (35.4)	<0.0001
Iron (mg)	5.1 (0.2)	3.2 (0.2)	<0.0001

¹P-value for differences in nutrient intakes between full and reduced size purchasers according to T- tests (P<0.05).

*Includes Halibut, Walleye, Salmon, Lamb, Strip Steak, and Filet Mignon (does not include specials or other menu items not available in full and reduced sizes).

Table 12 TCC Sales – number and percent of reduced-portion sized entrees prior and post intervention

	Full Sized Meals	Reduced -portion Meals	Total Meals	Reduced- portion
Time relative to menu change	n			%
Three weeks prior	79	5	84	6.0
Two weeks prior	65	10	75	13.3
One week prior	99	12	111	10.8
Week of menu change	57	26	83	31.3
First week post	91	21	112	18.8
Second week post	91	32	123	26.0
Third week post	77	32	109	29.4

Source: Observed choice data

Table 13 TCC demographic characteristics for respondents by survey phase

	Pre-phase Survey (n=212) n (%)	Post-phase Survey (n=134) n (%)	P-value¹
Age			0.94
<25 years old	0 (0)	0 (0)	
25-34 years old	12 (6.1)	7 (5.7)	
35-44 years old	45 (22.7)	33 (26.6)	
45-54 years old	62 (31.3)	35 (28.2)	
55-64 years old	52 (26.3)	33 (26.6)	
65 years or older	27 (13.6)	16 (12.9)	
Gender			0.32
Female	109 (55.6)	76 (61.3)	
Male	87 (44.4)	48 (38.7)	

¹P-value for differences in demographic characteristics between pre-phase and post-phase survey participants, according to chi square tests (P<0.05).

Table 14 TCC demographic characteristics for post-phase survey respondents by half portion buyer or non-buyer

	Half Portion Buyers (n=66) n (%)	Non-Half Portion Buyers (n=59) n (%)	P-value¹
Age			0.29
<25 years old	0 (0)	0 (0)	
25-34 years old	5 (7.6)	3 (5.1)	
35-44 years old	14 (21.2)	19 (32.2)	
45-54 years old	22 (33.3)	13 (22)	
55-64 years old	19 (28.8)	14 (23.7)	
65 years or older	6 (9.1)	10 (17)	
Gender			0.70
Female	38 (59.4)	37 (62.7)	
Male	26 (40.5)	22 (37.3)	

¹P-value for differences in demographic characteristics between post-phase half portion buyers and non-buyers, according to chi square tests (P<0.05).

Table 15 TCC post survey healthy behavior responses of “most of the time or always” by half portion buyer or non-buyer

	Half Portion Buyer (n=66)	Half Portion Non-Buyer (n=59)	P-value¹
Healthful Behaviors: How often do you...	n (%)	n (%)	
Eat balanced meals	61 (92.4)	53 (89.8)	0.609
Eat more fruit, vegetables and/or whole grain foods	53 (80.3)	46 (78)	0.748
Limit portion sizes to avoid overeating	57 (86.4)	42 (71.2)	0.037*
Avoid fat, cholesterol, salt and/or sugar	32 (48.5)	36 (61)	0.160
Exercise vigorously multiple times each week	37 (56.1)	42 (71.2)	0.080
Walk/take the stairs as often as I can	53 (80.3)	42 (71.2)	0.234
Follow a diet to lose weight	20 (30.3)	16 (27.1)	0.695
Watch my intake of certain foods because I have a specific health condition	9 (13.6)	18 (30.5)	0.022*
Watch my food intake to manage my weight	44 (66.7)	37 (62.7)	0.644

¹P-value for healthful behavior survey responses between full and reduced size purchasers according to T- tests (P<0.05).

*Significant at P<0.05.

Chapter 5: Discussion

This study found that a subgroup of customers at both Patterson Dental and the TCC selected the reduced-portion menu items with sales ranging from 10% to 30% across both food service environments. Both energy and nutrient intakes decreased and food waste was reduced. Interview results with food service managers indicated that the introduction of reduced-portion size entrees was profitable for both locations.

Selection of Reduced-Portion Menu Items

Reduced-portion entrée sales began slowly at Patterson Dental. During the first week the reduced-portion entrées were available, customers were confused as to how they could use their pre-paid \$3.00 meal ticket to purchase the \$1.50 reduced-size meal. After assurances from the cafeteria manager that they could use the ticket to cover 2 meals, sales of reduced-portion entrees averaged 10.3% of total entrée sales over the next 5 weeks. Reduced-portion entrée sales at TCC made up an even greater percentage of total entrée sales compared to Patterson. Sales of reduced-portion entrees increased from an average of 10% initially to 26.4% of total entrée sales after the additional reduced-portion entrees were added to the menu. In both locations, the hypothesis that sales of reduced-portion entrées would exceed 10% of total sales was accepted. In a similar study in the Netherlands, reduced-portion entrees

made up roughly 10% of total entrée sales.⁸⁶ More research is needed to determine whether this level of selection is great enough to impact overall intake and waste.

Two factors were not examined in this study, which may have impacted the percentage of individuals selecting the reduced-portion entrees. Numerous studies have shown that the eating behavior of others can be used to determine what is normal or appropriate within a community or peer group and can influence an individual's food selection and food intake.^{105,106,107,108} This study did not examine social norms, however the individual selection of either full or reduced-portion entrees may have been influenced by the choice of other diners at the table or the choice of the co-worker in front of them in the cafeteria line and thus impacted the percentage of reduced-portion entrée sales. Additionally, a study by MB Schwartz,¹⁰⁹ found that the inclusion of a verbal prompt, such as "Would you like fruit or juice with your lunch?" increased the percentage of youth selecting fruit or juice as part of their school lunch from 60% to 90%. This study did not include the use of a verbal prompt by either site, however it is possible that the use of a verbal prompt may have increased reduced-portion entrée sales beyond what was found in this study.

The difference in the percentage of reduced-portion sales between the 2 locations may be attributable to a number of factors. Increased familiarity is one factor that motivates food choices of consumers.¹¹⁰ Because reduced-portion sizes were available for the filet mignon prior to the start of the study at the TCC,

these consumers may have been more familiar with the concept of multiple portion sizes than customers at Patterson Dental. Increased familiarity may have increased their likelihood of ordering the reduced-portion meals. Reduced-portion meals were offered at dinner at the TCC and at lunch at Patterson Dental. Differences in customer expectations of usual amounts to consume at lunch and dinner may have influenced the percentage of reduced-portion meal sales. The difference between the price of the full portion entrée and the reduced-portion may also have affected sales. A savings of \$8-9 per meal at TCC may influence a consumer to purchase a reduced-portion entrée more than a savings of \$1.50 at Patterson. Additionally, age differences between the customers at the 2 locations could have affected sales. TCC survey respondents who indicated they purchased the reduced-portion entrée tended to be older. Almost 70% were over 45 years of age and 9% were 65 years or older compared to roughly 43% over 45 years and no respondents 65 years or older at Patterson Dental.

Effects on Energy and Nutrition Intakes

The selection of reduced-portion entrees resulted in decreased caloric consumption and intake of selected nutrients at both locations. Consumers who selected the reduced-portion entrees consumed fewer calories. These findings are consistent with those of Rolls et al. (2006),⁷⁵ Freedman and Brochado (2010),⁷⁶ and Schwartz (2012),⁷⁷ where decreased energy intake was observed with reduced-portion sizes compared to larger portion sizes. Additionally,

individuals in the current study who consumed the reduced-portion sized entrees had lower intakes of fat, saturated fat, cholesterol and sodium compared to those who consumed the regular portion-sized entrées. Since most chain restaurant entrees exceed USDA guidelines for calories, total fat, sodium and saturated fat,^{19,20,21} reducing portion sizes may help consumers meet USDA recommendation for intakes of these nutrients and energy. These benefits may be offset somewhat by the decrease in common shortfall nutrients such as fiber, calcium, potassium and iron. Adults, who consumed a meal away from home, consumed fewer fruits, vegetables, dairy and whole grains, compared to those who consumed a meal at home.¹⁸ Reducing the portion size of the meal does not alter the original nutrient density of the meal, so reducing the size of a meal already low in fruits, vegetables, dairy or whole grains, will either make no change or have a negative effect. To limit any negative impact of reduced-portion sizes on shortfall nutrients and food group intakes, the amounts of fruits, vegetables, dairy and whole grains should be increased prior to down-sizing entrees.

Effects on Subsequent Food Intake

Reduced energy and nutrient intakes were observed for reduced-portion buyers in the current study, but data on consumption of other menu items, such as a side salad or dessert were not collected. A previous study found that salad sales increased with the introduction of reduced-portions.⁸⁷ Another showed that

approximately 20% of reduced-portion buyers also purchased additional menu items.⁸⁶ The current study was able to collect data on some additional menu purchases, however it was limited to certain items. At Patterson Dental, purchases of side salads or soup was recorded, however it was not possible to determine which individuals purchased cookies, as these items were often not consumed in the dining room. At TCC, data were collected for the entire dining table, including side salads, appetizers and desserts. While data on side salads sales could be analyzed, many menu items such as appetizers and desserts were often shared. Without direct observation, the amount of these items each individual at the table consumed could not be determined.

Effects on Plate Waste

Like Freedman and Brochado (2010),⁷⁶ reductions in plate waste were also observed for customers who purchased the reduced-portion entrees compared to the full portion entrees at both Patterson and TCC. The plate waste generated by reduced-portion purchasers was reduced by approximately 35% at Patterson Dental and 40% at the TCC compared to full size purchasers. Reduced food waste can result in decreased food costs and waste disposal costs. Decreased food waste also limits the production of greenhouse gases as less food ends up in landfills. Additional studies are needed to quantify the impact of reduced-portion entrees on the total waste of a food service establishment.

Effects on Business Profitability

The impact of introducing reduced-portion entrees on business profitability was explored through follow-up interviews with the management teams at each location. Both management teams found the change to be profitable, either through reductions in costs or through increased profit margins and restaurant traffic. Both locations have continued to offer reduced-portion entrees beyond the completion of the study. Wansink⁸⁷ also observed that the introduction of reduced-portion sized entrees led to an increase in monthly sales over the same months from the previous year.

Characteristics of Reduced-Portion Buyers

Vermeer et al. found that women were more inclined to purchase reduced-portion entrées than men, which is consistent with the findings in the current study. Close to 60% of reduced-portion entrees at both at Patterson Dental and the TCC were women. Other studies have found women to be more health conscious than men. Women are also more likely than men to utilize menu labeling to choose healthier menu options.¹¹¹ At the TCC many older individuals purchased the reduced-portion entrees.

Reduced-portion buyers at Patterson Dental who completed surveys appeared to be no more health conscious than non-buyers. No significant differences were observed between buyers and non-buyers for perceived importance of needs at lunch and frequency of engaging in healthful behaviors.

However at TCC, significant differences existed in the frequency with which customers reported engaging in several healthful behaviors. Those who purchased the reduced-portion items were more likely to limit portion sizes to avoid overeating than individuals who did not purchase the reduced items. However those who purchased full size menu items were more likely to watch their intake of certain foods because of a health condition. It is unclear from this study, why these individuals with health conditions did not choose to purchase a reduced-portion entrée. More research is needed to determine motivation for selecting the reduced-portion menu items.

Restaurant Feasibility

Increased sales and profits are the main considerations most restaurants make when determining what items to include on their menu.⁷⁸ Restaurant customers want food to taste good, but they also want healthier options.¹ Healthier options can be difficult to find at some restaurants or may not meet taste preferences of consumers.²¹ Reduced-portion size entrees may be an alternative that provides both taste and healthier menu options. Because reducing the portion size does not impact the flavor profile of the entrée, it may appeal to more consumers.

A previous study interviewed 18 restaurant owners regarding the feasibility of offering reduced-size menu items.⁸⁴ The owners expressed concerns regarding logistical challenges, additional training, increased costs associated

with smaller sized products and reduced revenues. The management teams at both Patterson Dental and the TCC indicated that the process of adding the reduced-portion entrees required some additional work initially to ensure the staff was fully trained and to determine specifications for the amount of food to prepare. After a short transition period, they believed the process was relatively easy. While introducing reduced-portions was successful at Patterson Dental and the TCC, other types of food service environments may have different issues regarding the feasibility of adding reduced-portions to their menus. A recent study identified additional risks with reduced-portions.¹¹² Value perception may be impaired if customers do not feel that they are receiving a good value for their money. Reduced-portion sizes may reduce meal enjoyment by customers, which may harm repeat business. Reduced-portions could impact the cost of goods purchased if the reduction exceeds any volume discount offered by suppliers. The study also identified 10 marketing and behavioral economic approaches that could be employed to counter the identified risks. These included changing the default to a smaller portion, changing packaging/plate size, making smaller portions easier to find, adding additional small sized options to the menu, and using linear pricing. Some of these methods were utilized in the current study; including using smaller serving plates for the reduced sized items and adding additional small sized menu items. These methods may have positively influenced the results of this study.

Strengths and Limitations

The strengths of this study are in its novelty. Limited studies have measured the impact of reduced-portion sized entrees on sales, nutrient intake, and plate waste in food service settings. Two studies have examined reduced-portion sizes in a cafeteria setting^{76,86} and one examined sales of reduced-portion items in a restaurant.⁸⁷ Another strength is that the current study was conducted in 2 different types of food service environments and similar results were observed.

This study also had limitations, some of which were due to the constraints of conducting research in a restaurant setting. Researchers were unable to track consumption by individual participants due to limitations imposed by food service management. In addition, the current study was unable to report the impact of reduced-portions beyond a single meal to determine if smaller portion sizes at a single meal resulted in an overall decrease in daily caloric intake. Small sample sizes make the comparison of gender differences difficult to determine. At the TCC, researchers were stationed in the kitchen and thus were unable to observe diners consuming the meal, therefore consumption amounts may have been misreported if diners shared or dropped a portion of the meal. This study was conducted in a business cafeteria setting and a country club restaurant setting, both of which have a constant client base. This may limit application of results to other types of restaurants. Further research is necessary to confirm these results in other types of dining establishments.

Conclusions and Implications for Future Research

The results of this study suggest that a portion of restaurant customers will purchase reduced-size menu items if given the opportunity. The customers who purchased the reduced-portion entrées consumed fewer calories, decreased their intake of both nutrients of concern as well as a number of shortfall nutrients, and had decreased plate waste compared to those who purchased the full portion entrée.

Further research into reduced-portion sizes should examine the impact of adding reduced-portion sizes into different types of restaurants, such as family style, quick service, chain restaurants and independent restaurants. Because both of the settings in the current study had an existing customer base, additional studies should also examine the motives for restaurant selection and determine if the addition of reduced-portion sizes to a restaurant's menu impacts the customer's restaurant selection.

The current study did not examine the impact of purchasing reduced-portion size entrees on sales and intake of other menu items. Additionally, since studies have shown that increased portion sizes at a single meal can increase consumption at subsequent meals^{55,59,61,63}, future studies should examine the effect of reduced-portion sizes on the consumption of other menu items and consumption at subsequent meals.

Plate waste was significantly reduced for reduced-portion buyers compared to non-buyers, however the impact of this change on total food waste

generated by the food service environment was not measured in the current study. Additional studies should be done to quantify the effects on total food waste.

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Appendices:

Appendix 1 Patterson Dental Survey 1



(Note: Print on one page – 2 sides)

Patterson Dental is partnering with researchers from the University of Minnesota to conduct research on our cafeteria operations and menu selection. As part of this research, we are asking cafeteria users to complete a brief survey on menu selection and satisfaction. Please answer the following questions and return the completed survey questionnaire by e-mail or drop in the indicated box in the cafeteria. Your response will be used to provide menu items and service to better meet the needs of Patterson's employees.

1. Over the **past two weeks** how often have you purchased lunch in the Patterson Cafeteria? (Please check one box)

None	Once	Twice	3 Times	4 Times	5 Times	6 Times	7 Times	8 Times	9 Times	10 Times +

2. How would you rate your satisfaction level with the Cafeteria on each of the following topics using a 1-5 scale where **5 means you are COMPLETELY SATISFIED**, and **1 means you are NOT AT ALL SATISFIED**. (Please check one box for each topic)

	1 – Not At All Satisfied	2	3	4	5 – Completely Satisfied
Overall Satisfaction					
Convenience/Accessibility					
Quality of Food/Taste Appeal					
Price/Value					
Appetite Satisfaction					
Health/Nutrition					
Environmental Impact					

3. During the **past two weeks**, how often have you purchased each of the following **menu items** in the cafeteria? (Please check the number of times you purchased each menu item as best you can recall.)

	None	Once	Twice	3 Times	4 Times	5 Times	6 Times	7 Times	8 Times	9 Times	10 Times +
The daily entrée (with or without sides)											
The regular sandwich of the day											
The half sandwich of the day											
The regular salad bar serving											
The half salad bar serving											
Cookies											
Ice Cream											
Fruit											

4. For any of the following items that you have purchased in the cafeteria during the **past two weeks**, please rate your **overall satisfaction** level using a 1-5 scale where **5 means you are COMPLETELY SATISFIED**, and **1 means you are NOT AT ALL SATISFIED**. (Please check one box for each menu item – skip items you have not purchased in the past two weeks)

	1 – Not At All Satisfied	2	3	4	5 – Completely Satisfied
The daily entrée (with or without sides)					
The regular sandwich of the day					
The half sandwich of the day					
The regular salad bar serving					
The half salad bar serving					
Cookies					
Ice Cream					
Fruit					

5. During the past two weeks have you *noticed any changes in the foods offered* in the cafeteria?

- No
 Yes – If so what changes *did you notice*?
(Please specify below) _____

6. Using a scale of 1-5 with **5 meaning EXTREMELY IMPORTANT** and **1 meaning NOT AT ALL IMPORTANT** please rate each of the following possible needs you may experience with respect to how important they are to you at lunch time on working days? (Please check one box for each need)

	1 – Not At All Important	2	3	4	5 – Extremely Important
Convenience/Accessibility					
Quality of Food/Taste Appeal					
Price/Value					
Appetite Satisfaction					
Health/Nutrition					
Environmental Impact					

7. How often do you do each of the following using a 1-5 scale where 5 = ALWAYS, 4 = MOST OF THE TIME, 3 = OCCASIONALLY, 2 = RARELY, and 1 = NEVER? Please check one box for each type of behavior)

	1 – Never	2 - Rarely	3 - Occasionally	4 – Most of the Time	5 – Always
Eat balanced meals					
Eat more fruit, vegetables and/or whole grain foods					
Limit my portion sizes to avoid overeating					
Avoid fat, cholesterol, salt and/or sugar					
Exercise vigorously multiple times each week					
Walk/take the stairs as often as I can					
Follow a diet to lose weight					
Watch my intake of certain foods because I have a specific health condition					
Watch my food intake to manage my weight					

8. For classification purposes would you please indicate your *age range* and *gender*?

- | | |
|-----------------------------------|---------------------------------|
| <u>Age</u> | <u>Gender</u> |
| <input type="checkbox"/> Under 25 | <input type="checkbox"/> Male |
| <input type="checkbox"/> 25 – 34 | <input type="checkbox"/> Female |
| <input type="checkbox"/> 35-44 | |
| <input type="checkbox"/> 45-54 | |
| <input type="checkbox"/> 55-64 | |
| <input type="checkbox"/> Over 64 | |

9. Please add any **suggestions or comments** you would like to offer about how the Cafeteria can better meet your needs.

Thank You – Jeremy Figy

Appendix 2

Patterson Dental Survey 2



Patterson Dental is partnering with researchers from the University of Minnesota to conduct research on our cafeteria operations and menu selection. As part of this research, we are asking cafeteria users to complete a brief survey on menu selection and satisfaction. Please answer the following questions and return the completed survey questionnaire by e-mail or drop in the indicated box in the cafeteria. Your response will be used to provide menu items and service to better meet the needs of Patterson's employees.

1. Over the *past two weeks* how often have you purchased lunch in the Patterson Cafeteria? (Please check one box)

None	Once	Twice	3 Times	4 Times	5 Times	6 Times	7 Times	8 Times	9 Times	10 Times +

2. How would you rate your satisfaction level with the Cafeteria on each of the following topics using a 1-5 scale where 5 means you are **COMPLETELY SATISFIED**, and 1 means you are **NOT AT ALL SATISFIED**. (Please check one box for each topic)

	1 – Not At All Satisfied	2	3	4	5 – Completely Satisfied
Overall Satisfaction					
Convenience/Accessibility					
Quality of Food/Taste Appeal					
Price/Value					
Appetite Satisfaction					
Health/Nutrition					
Environmental Impact					

3. During the *past two weeks*, how often have you purchased each of the following *menu items* in the cafeteria? (Please check the number of times you purchased each menu item as best you can recall.)

	None	Once	Twice	3 Times	4 Times	5 Times	6 Times	7 Times	8 Times	9 Times	10 Times +
The daily entrée (with or without sides) – Full Portion											
The daily entrée (with or without sides) – Half Portion											
The regular sandwich of the day											
The half sandwich of the day											
The regular salad bar serving											
The half salad bar serving											
Cookies											
Ice Cream											
Fruit											

4. For any of the following items that you have purchased in the cafeteria during the *past two weeks*, please rate your *overall satisfaction* level using a 1-5 scale where 5 means you are **COMPLETELY SATISFIED**, and 1 means you are **NOT AT ALL SATISFIED**. (Please check one box for each menu item – skip items you have not purchased in the past two weeks)

	1 – Not At All Satisfied	2	3	4	5 – Completely Satisfied
The daily entrée (with or without sides) – Full Portion					
The daily entrée (with or without sides) – Half Portion					
The half sandwich of the day					
The regular salad bar serving					
The half salad bar serving					
Cookies					
Ice Cream					
Fruit					

5. During the past two weeks have you *noticed* any *changes in the foods offered* in the cafeteria?

- No
 Yes – If so what changes *did you notice*?
 (Please specify below) _____

6. Using a scale of 1-5 with 5 meaning **EXTREMELY IMPORTANT** and 1 meaning **NOT AT ALL IMPORTANT** please rate each of the following possible needs you may experience with respect to how important they are to you at lunch time on working days? (Please check one box for each need)

	1 – Not At All Important	2	3	4	5 – Extremely Important
Convenience/Accessibility					
Quality of Food/Taste Appeal					
Price/Value					
Appetite Satisfaction					
Health/Nutrition					
Environmental Impact					

7. How often do you do each of the following using a 1-5 scale where 5 = **ALWAYS**, 4 = **MOST OF THE TIME**, 3 = **OCCASIONALLY**, 2 = **RARELY**, and 1 = **NEVER**? Please check one box for each type of behavior)

	1 – Never	2 - Rarely	3 - Occasionally	4 – Most of the Time	5 – Always
Eat balanced meals					
Eat more fruit, vegetables and/or whole grain foods					
Limit my portion sizes to avoid overeating					
Avoid fat, cholesterol, salt and/or sugar					
Exercise vigorously multiple times each week					
Walk/take the stairs as often as I can					
Follow a diet to lose weight					
Watch my intake of certain foods because I have a specific health condition					
Watch my food intake to manage my weight					

8. For classification purposes would you please indicate your *age range* and *gender*?

- | | |
|-----------------------------------|---------------------------------|
| <u>Age</u> | <u>Gender</u> |
| <input type="checkbox"/> Under 25 | <input type="checkbox"/> Male |
| <input type="checkbox"/> 25 – 34 | <input type="checkbox"/> Female |
| <input type="checkbox"/> 35-44 | |
| <input type="checkbox"/> 45-54 | |
| <input type="checkbox"/> 55-64 | |
| <input type="checkbox"/> Over 64 | |

9. Please add any **suggestions or comments** you would like to offer about how the Cafeteria can better meet your needs.

Thank You – Jeremy Figy

Appendix 3 Patterson Dental Plate Waste Data Collection Protocol

Protocol: To assess the amount of consumption and food waste at the level of the individual customer at a food service site.

Advanced Preparation:

1. Dress in business casual attire (no jeans)
2. Wear a hat/hairnet as required in kitchen area
3. Follow all kitchen regulations – no eating/no cell phones
4. Set up scales/equipment in designated location in dishwashing area
5. Test scales to ensure accuracy. Place test item on both scales to ensure same weight measurement from each scale.
6. Set out labeled sample plates as a reference to ensure data is recorded correctly
7. Weigh and record weights of salad components on Salad Bar sheet
8. Record the number of cookies and fruit set out at beginning of lunch
9. Fill out top of each individual record sheet (One side is ok). Include date, day of week, name and menu entrée item and sides.
10. Set up rolling carts - One to wastebasket area in dining room and the other located in the dishwashing area.

Process During Lunch Period:

At the start of lunch, one person is stationed near the garbage area and one person is stationed in the dishwashing area. Additional staff may assist where needed.

Person at Garbage Area:

1. As customers finish eating, the individual stationed near the garbage cans will take the plates and bowls with food waste and place. If an individual has more than one plate or bowl please stack for each Individual on rolling cart. Keep each individual's plates and bowls together so we can determine total calories consumed.
2. Instruct customers to toss all paper waste and place tray, cup and silverware at the return station. Cracker or condiment wrappers should remain on plates to account for intake.
3. When cart is full, exchange cart with an empty cart. Exchange cart as needed throughout lunch period.
4. Ensure plates are gathered for all customers.

Person in Dishwashing Area:

1. Obtain cart filled with plates and bowls.
2. Different menu items will be placed on different colored plates. Place sample plates with menu item recorded on it nearby for reference.

3. Tare each empty scale.
4. Weigh total plate with waste. Record weight on data collection form.
5. Remove main entree item and weigh plate again with sides only. Record on data collection form.
6. Remove starch side dish and weigh plate again with vegetable only. Record on data collection form.
7. If plate contains excess ketchup, mustard or sauces or dressings, remove food items and place on empty plate for weighing. This will account only for menu items. Food items located in the sauce should be wiped off to remove excess sauce. Record that the plate had excess condiments on record sheet.
8. Empty plates should be recorded as -0- food waste in the appropriate box on data sheet.
9. Ensure that if individual has multiple plates, they get recorded together.
10. There are two different types of soup bowls with different weights. They are labeled on the bottom of the bowl with either a picture or a company name. Please place a check mark by the type of bowl used.

Process After Lunch

1. Clean up work area. Return any items to designated locations
2. Weigh Salad bar items again and record on salad bar form. Once weighed, place salad bar items on salad cart.
3. Ensure that all data sheets, scales, sample plates are collected and given to Sarah.

Appendix 4 Patterson Dental Serving Size Weights Data Collection Form

DATE _____

PRE- WEIGHTS (BY ITEM)

1.

2.

3.

4.

5.

Appendix 5 Patterson Dental Food Waste Data Collection Form

Date _____ M T W TH F

Name _____

ENTRÉE _____

SIDES _____

	Total	- Main (Sides only)	- Starch (Veg only)
Entrée - Lg			
Entrée - S			
Sandwich - Lg			
Sandwich - ½			
Alt. Side - Soup (S)/Salad(V)		Condiments on plate - ✓	
Salad - Lg			
Salad - S		Soup Bowl	- ✓
Soup - Bowl		- Buffalo	
Soup - Cup		- Words	
Cookie		Fruit	

	Total	- Main (Sides only)	- Starch (Veg only)
Entrée - Lg			
Entrée - S			
Sandwich - Lg			
Sandwich - ½			
Alt. Side - Soup (S) /Salad (V)		Condiments on plate - ✓	
Salad - Lg			
Salad - S		Soup Bowl	- ✓
Soup - Bowl		- Buffalo	
Soup - Cup		- Words	
Cookie		Fruit	

	Total	- Main (Sides only)	- Starch (Veg only)
Entrée - Lg			
Entrée - S			
Sandwich - Lg			
Sandwich - ½			
Alt. Side - Soup (S) /Salad (V)		Condiments on plate - ✓	
Salad - Lg			
Salad - S		Soup Bowl	- ✓
Soup - Bowl		- Buffalo	
Soup - Cup		- Words	
Cookie		Fruit	

	Total	- Main (Sides only)	- Starch (Veg only)
Entrée - Lg			
Entrée - S			
Sandwich - Lg			
Sandwich - ½			
Alt. Side - Soup (S) /Salad (V)		Condiments on plate - ✓	
Salad - Lg			
Salad - S		Soup Bowl	- ✓
Soup - Bowl		- Buffalo	
Soup - Cup		- Words	
Cookie		Fruit	

	Total	- Main (Sides only)	- Starch (Veg only)
Entrée - Lg			
Entrée - S			
Sandwich - Lg			
Sandwich - ½			
Alt. Side - Soup (S) /Salad (V)		Condiments on plate - ✓	
Salad - Lg			
Salad - S		Soup Bowl	- ✓
Soup - Bowl		- Buffalo	
Soup - Cup		- Words	
Cookie		Fruit	

	Total	- Main (Sides only)	- Starch (Veg only)
Entrée - Lg			
Entrée - S			
Sandwich - Lg			
Sandwich - ½			
Alt. Side - Soup (S) /Salad (V)		Condiments on plate - ✓	
Salad - Lg			
Salad - S		Soup Bowl	- ✓
Soup - Bowl		- Buffalo	
Soup - Cup		- Words	
Cookie		Fruit	

Appendix 6 Patterson Dental and TCC Debriefing Interview Questions

Debriefing Interview

- a. Do you feel the portion reductions were a success
 - i. Overall
 - ii. From a business standpoint
 - iii. From any other standpoint.
- b. What was successful, and how so.
- c. What challenges did the changes pose to your operations?
- d. What did you and your staff learn during the test?
- e. Did the changes require some getting used to:
 - i. By staff
 - ii. By customers
- f. What feedback have you received from your customers?
- g. How did your staff feel about the half portions?
- h. Do half portions work better for some menu items than others?
What general principles have you gained for how they work best?
- i. What (if any) are your longer term plans for reduced portions
- j. How would you characterize your experience in conducting the test with our research team:
 - i. What worked well
 - ii. What didn't work so well
 - iii. Wishes
- k. Do you have any further comments, questions or concerns about the study or how we will be using the findings?

Appendix 7 TCC Survey 1



Town & Country Club is partnering with researchers from the **University of Minnesota** to conduct research on our dining facility operations and menu offerings. As part of this research, we are asking our members to complete a brief survey on menu selection. Please answer the following questions by April 30th. Your response will be used to provide menu items and service to better meet the needs of Town & Country Club's membership. Please note that your answers will be kept strictly confidential, and that no responses from individual members will not be reported or kept on file.

1. During the **past 3 weeks**, which of the following menu items have you and your party purchased at Town and Country Club? (Please check one for each item).

Main Entrees:	Presentation	Have Not Purchased	Not Sure	Have Purchased
Grilled Filet Mignon – 4 Ounce	<i>Herbed Potatoes, spring vegetable sauté, red wine reduction</i>			
Grilled Filet Mignon – 6 Ounce	<i>Herbed Potatoes, spring vegetable sauté, red wine reduction</i>			
Grilled Filet Mignon – 8 Ounce	<i>Herbed Potatoes, spring vegetable sauté, red wine reduction</i>			
Cedar Plank Scottish Salmon	<i>Spring vegetable risotto, garlic spinach, ginger rhubarb compote</i>			
Dry Aged Certified Angus Strip Steak	<i>Caramelized onion mashed potatoes, spring asparagus</i>			
Farmer Pie	<i>Mock duck, root vegetables, sweet onion buttermilk mashed potatoes</i>			
Pan Fried Walleye	<i>Spring vegetable risotto, carrot batons, bordel sauce</i>			
Lemon Tarragon Halibut	<i>Herbed new potatoes, spring vegetable sauté, hazel nut brown butter</i>			
Pistachio Crusted Lamb Chops	<i>Spring vegetable risotto, smoked peas, olive salsa verde</i>			
Small Plates:				
Hand Battered Onion Rings				

2. During the **next 3 weeks** how likely would you be to purchase each of the following menu items if available at Town and Country Club? *Each entrée would be served with the same presentation as described above.* (Please check one box for each menu item.)

Main Entrees:	Size	Price \$	Definitely Would Not Buy	Probably Would Not Buy	Might or Might Not Buy	Probably Would Buy	Definitely Would Buy
Grilled Filet Mignon	4 Ounce	25					
Grilled Filet Mignon	6 Ounce	29					
Grilled Filet Mignon	8 Ounce	32.5					
Cedar Plank Scottish Salmon	Full Portion (7 Ounce)	24					
Cedar Plank Scottish Salmon	Reduced portion (4 Ounce)						
Dry Aged Certified Angus Strip Steak	Full Portion (12 Ounce)	36					
Dry Aged Certified Angus Strip Steak	Reduced Portion (6 Ounce)						
Farmers Pie	Full Portion	19					
Pan Fried Walleye	Full Portion (10 Ounce)	24					
Pan Fried Walleye	Reduced Portion (5 Ounce)						
Lemon Tarragon Halibut	Full Portion (7 Ounce)	26					
Lemon Tarragon Halibut	Reduced Portion (4 Ounce)						
Pistachio Crusted Lamb	Full Portion – 3 Double Bone	29					
Pistachio Crusted Lamb Chops	Reduced Portion – 2 Double Bone						
Small Plates:							
Hand Battered Onion Rings	Full Basket						
Hand Battered Onion Rings	Half Basket						

3. Next, we would like to ask you about your nutritional preferences to help us tailor our menu to the needs of Town and Country Club's membership. Please indicate how often you do each of the following using a 1-5 scale where 5 = Always, 4 = Most of the Time, 3 = Occasionally, 2 = Rarely, and 1 = Never? (Please check one box for each)

	1 - Never	2 - Rarely	3 - Occasionally	4 - Most of the Time	5 - Always
<input type="checkbox"/> Eat balanced meals					
<input type="checkbox"/> Eat more fruit, vegetables and/or whole grain foods					
<input type="checkbox"/> Limit my portion sizes to avoid overeating					
<input type="checkbox"/> Avoid fat, cholesterol, salt and/or sugar					
<input type="checkbox"/> Exercise vigorously multiple times each week					
<input type="checkbox"/> Walk/take the stairs as often as I can					
<input type="checkbox"/> Follow a diet to lose weight					
<input type="checkbox"/> Watch my intake of certain foods because I have a specific health condition					
<input type="checkbox"/> Watch my food intake to manage my weight					

8. For classification purposes would you please indicate your *age range* and *gender*?

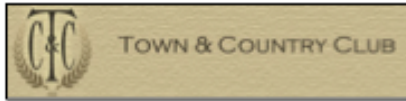
- | | |
|-----------------------------------|---------------------------------|
| <u>Age</u> | <u>Gender</u> |
| <input type="checkbox"/> Under 25 | <input type="checkbox"/> Male |
| <input type="checkbox"/> 25 - 34 | <input type="checkbox"/> Female |
| <input type="checkbox"/> 35-44 | |
| <input type="checkbox"/> 45-54 | |
| <input type="checkbox"/> 55-64 | |
| <input type="checkbox"/> Over 64 | |

9. Please add any **suggestions or comments** you would like to offer about how Town & Country Club can better meet your dining needs.

*Thank You,
John Kain
Executive Chef, Town & Country Club*

Appendix 8

TCC Survey 2



Town & Country Club is partnering with researchers from the University of Minnesota to conduct research on our dining facility operations and menu offerin part of this research, we are asking our members to complete a second of two brief surveys on menu selection. Please answer the following questions by May. Your response will be used to provide menu items and service to better meet the needs of Town & Country Club's membership. Please note that your answer kept strictly confidential, and that no responses from individual members will not be reported or kept on file.

1. During the **past 3 weeks**, which of the following menu items have you and your party purchased at Town and Country Club? (Please check one for each item).

Main Entrees:	Size	Price \$	Have Not Purchased	Not Sure	Have Purchased
Grilled Filet Mignon	4 Ounce	25			
Grilled Filet Mignon	6 Ounce	29			
Grilled Filet Mignon	8 Ounce	32.5			
Cedar Plank Scottish Salmon	Full Portion (7 Ounce)	24			
Cedar Plank Scottish Salmon	Reduced portion (4 Ounce)				
Dry Aged Certified Angus Strip Steak	Full Portion (12 Ounce)	36			
Dry Aged Certified Angus Strip Steak	Reduced Portion (6 Ounce)				
Farmers Pie	Full Portion	19			
Pan Fried Walleye	Full Portion (10 Ounce)	24			
Pan Fried Walleye	Reduced Portion (5 Ounce)				
Lemon Tarragon Halibut	Full Portion (7 Ounce)	26			
Lemon Tarragon Halibut	Reduced Portion (4 Ounce)				
Pistachio Crusted Lamb	Full Portion – 3 Double Bone	29			
Pistachio Crusted Lamb Chops	Reduced Portion – 2 Double Bone				
Small Plates:					
Hand Battered Onion Rings	Full Basket				
Hand Battered Onion Rings	Half Basket				

2. During the **next 3 weeks** how likely would you be to purchase each of the following menu items if available at Town and Country Club? *Each entrée would be served with the same presentation as described above.* (Please check one box for each menu item.)

Main Entrees:	Size	Price \$	Definitely Would Not Buy	Probably Would Not Buy	Might or Might Not Buy	Probably Would Not Buy	Definitely Would Not Buy
Grilled Filet Mignon	4 Ounce	25					
Grilled Filet Mignon	6 Ounce	29					
Grilled Filet Mignon	8 Ounce	32.5					
Cedar Plank Scottish Salmon	Full Portion (7 Ounce)	24					
Cedar Plank Scottish Salmon	Reduced portion (4 Ounce)						
Dry Aged Certified Angus Strip Steak	Full Portion (12 Ounce)	36					
Dry Aged Certified Angus Strip Steak	Reduced Portion (6 Ounce)						
Farmers Pie	Full Portion	19					
Pan Fried Walleye	Full Portion (10 Ounce)	24					
Pan Fried Walleye	Reduced Portion (5 Ounce)						
Lemon Tarragon Halibut	Full Portion (7 Ounce)	26					
Lemon Tarragon Halibut	Reduced Portion (4 Ounce)						
Pistachio Crusted Lamb	Full Portion – 3 Double Bone	29					
Pistachio Crusted Lamb Chops	Reduced Portion – 2 Double Bone						
Small Plates:							
Hand Battered Onion Rings	Full Basket						
Hand Battered Onion Rings	Half Basket						

3. Next, we would like to ask you about your nutritional preferences to help us tailor our menu to the needs of Town and Country Club's membership. Please indicate how often you do each of the following using a 1-5 scale where 5 = Always, 4 = Most of the Time, 3 = Occasionally, 2 = Rarely, and 1 = Never? (Please check one box for each)

	1 - Never	2 - Rarely	3 - Occasionally	4 - Most of the Time	5 - Always
Eat balanced meals					
Eat more fruit, vegetables and/or whole grain foods					
Limit my portion sizes to avoid overeating					
Avoid fat, cholesterol, salt and/or sugar					
Exercise vigorously multiple times each week					
Walk/take the stairs as often as I can					
Follow a diet to lose weight					
Watch my intake of certain foods because I have a specific health condition					
Watch my food intake to manage my weight					

8. For classification purposes would you please indicate your *age range* and *gender*?

- | | |
|-----------------------------------|---------------------------------|
| <u>Age</u> | <u>Gender</u> |
| <input type="checkbox"/> Under 25 | <input type="checkbox"/> Male |
| <input type="checkbox"/> 25 - 34 | <input type="checkbox"/> Female |
| <input type="checkbox"/> 35-44 | |
| <input type="checkbox"/> 45-54 | |
| <input type="checkbox"/> 55-64 | |
| <input type="checkbox"/> Over 64 | |

9. Please add any **suggestions or comments** you would like to offer about how Town & Country Club can better meet your dining needs.

Thank You,
John Kain
Executive Chef, Town & Country Club

Appendix 9

TCC Food Waste Data Collection Form

_____ Table # # of people _____

SHARED:

Appetizer _____ oz Appetizer (2) _____ oz

Bread: Extra: Y N Weight: _____

Dessert _____ oz Dessert (2) _____ oz

1. M / F Age _____

Entrée _____ Salad/Dressing _____ oz

Initial _____

Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____

Other _____ oz Dessert _____ oz

2. M / F Age _____

Entrée _____ Salad/Dressing _____ oz

Initial _____

Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____

Other _____ oz Dessert _____ oz

3. M / F Age _____

Entrée _____ Salad/Dressing _____ oz

Initial _____

Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____

Other _____ oz Dessert _____ oz

4. M / ~~F~~E Age _____

Entrée _____ Salad/Dressing _____ oz

Initial _____

Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____

Other _____ oz Dessert _____ oz

5. M / F Age _____
Entrée _____ Salad/Dressing _____ oz _____
Initial _____
Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____
Other _____ oz _____ Dessert _____ oz _____

6. M / F Age _____
Entrée _____ Salad/Dressing _____ oz _____
Initial _____
Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____
Other _____ oz _____ Dessert _____ oz _____

7. M / F Age _____
Entrée _____ Salad/Dressing _____ oz _____
Initial _____
Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____
Other _____ oz _____ Dessert _____ oz _____

8. M / F Age _____
Entrée _____ Salad/Dressing _____ oz _____
Initial _____
Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____
Other _____ oz _____ Dessert _____ oz _____

9. M / F Age _____
Entrée _____ Salad/Dressing _____ oz _____
Initial _____
Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____
Other _____ oz _____ Dessert _____ oz _____

10. M / F Age _____
Entrée _____ Salad/Dressing _____ oz _____
Initial _____
Plate total _____ Meat (boat) _____ Veg (boat) _____ Starch (boat) _____
Other _____ oz _____ Dessert _____ oz _____