An Empirical Study on the Influence of Social Networks and Menu Labeling on Calorie Intake in a University Dining Hall

by

Dan Wang

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Graduate Supervisory Committee:

Carola Grebitus, Chair
Christiane Schroeter
Mark Manfredo
Renee Hughner

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ABSTRACT

Obesity is a major health problem for both adults and children. It is particularly important for college students to focus on weight management due to weight persistence from adolescent to adult. This study analyzes the influence of peer effects and menu labeling on calorie intake at a university dining hall with posted nutrition facts. Data were collected at the Citrus Dining Hall on Polytechnic Campus of Arizona State University by means of a questionnaire. Groups of four members each were interviewed for a total of 112 individual observations. The results show that individuals who are dining in a group with at least one obese member consume more calories. Also food-related interactions in a group influence the amount of calorie consumption regarding pizza and pasta. Looking at nutrition facts when ordering the food decreases the amount of calories but the effects of menu labeling on calorie intake are not amplified through peer effects. The strength of ties indicated by closeness does not significantly influence calorie intake. There is a need for future research in which more approaches related to social networks need to be tested regarding healthy diets.

DEDICATION

I would like to dedicate my thesis to my husband, Bo Li, and my son, Eric Zexin Li. They give me countless support and encouragement and I am sincerely grateful for having them in my life. I also dedicate my thesis to my loving parents. They are the best and supportive parents in the world.

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INTRODUCTION

Background

Obesity in the United States has been continually increasing since the 1990's and there is no apparent sign of slowing down. According to the 2009-2010 data from the National Health and Nutrition Examination Survey (NHANES), more than two-thirds (68.8%) of U.S. adults were considered to be overweight or obese and more than one-third of U.S. adults (35.7%) were considered to be obese (Ogden et al., 2012). Obesity increases the risk of developing chronic diseases, such as type II diabetes, heart disease, hypertension, liver disease, osteoarthritis, some type of cancers, and stroke (Duyff, 2012), and even causes preventable death (Burton et al., 2006; Flegal et al., 2004a; Flegal et al., 2004b). Consequently, obesity tremendously increases medical care costs (Finkelstein et al., 2005; Finkelstein et al., 2009) and government expenditures (Finkelstein et al., 2005). The bias and discrimination against obese individuals may occur in the circumstances of employment, health care, education (Puhl & Brownell, 2001). Thus, obesity has also become a major social issue of relevance to society as a whole.

According to the National Heart, Lung and Blood Institute, being overweight and obese is attributed to many causes, including lack of energy balance, an inactive lifestyle, environment, genetic and family history, health condition, medicine, emotional factors, smoking, age, pregnancy, and lack of sleep. Many studies agree that the environment contributes more to the obesity epidemic than other factors related to biology (Hill & Peters, 1998; French et al., 2001; Hill et al., 2003). An obesogenic environment is

characterized by an extensive availability of high fat, energy-dense, inexpensive and highly convenient foods (U. S. Department of Agriculture and U. S. Department of Health and Human Service, 2010; Hill & Peters, 1998). USDA loss-adjusted food availability data reveal that average daily calories available per capita have reached 2,568 calories in 2010, an increase of about 22% compared to 2,109 calories in 1970, along with a large increase in the availability of added fat and oils. In addition, the obesogenic environment has been further promoted by the boom of the restaurant industry, especially fast food chain restaurants which have widely spread over all environmental settings, such as neighborhood, company, school, hospital and university.

With the exposure to this environment, people often consume excess calories from food provided by restaurants and therewith develop overweight or obesity because individuals significantly underestimate the calorie content of restaurant food (Burton et al, 2006; Chandon & Wansick, 2007a), especially for high calorie food (Burton et al, 2006). Among the societal issues, obesity may be prevented through behavioral changes induced via menu labeling which provides more accurate and detailed nutrition information (Krieger & Saelens, 2013; Swartz et al., 2011). Along with the enforcement of menu-related legislation from statewide to nationwide, menu labeling has been proposed as a public health policy to help consumers make better food choices when consuming restaurant foods (Nestle & Jacobson, 2000; Harnack & French, 2008; Nestle, 2010). Thus, policy makers are increasingly interested in determining whether and to what extent a relationship between menu labeling, i.e., the posted caloric content on the menu board, and food consumption exists.

Among food consumers, college students are a group in which the rate of overweight and obesity has greatly increased. On the one hand, Ogden et al. (2012) reported that the obesity rate of U.S. children and adolescents has reached 16.9% between 2009 and 2010, and adolescents appeared to have a higher prevalence of obesity compared to younger children. The overweight and obesity of adolescents tends to be carried into adulthood when they enter college. Furthermore, many university food providers, such as lunch rooms, all-you-can-eat dining halls and cafeterias, resemble fast food restaurants and accept university meal plans as well (Chu et al., 2009). Thus, college students may easily develop unhealthy eating habits because of the exposure to the environment with high food availability and the high frequency intake of food away from home (Poovey, 2008).

On the other hand, college students are a highly active social group. They may have class together, dine together, and enjoy their leisure time together. College peers' body weight and weight-related behavior may potentially influence each other during the frequent interaction of daily life because the behavior related to weight gain and weight loss appear to be socially transmissible (Smith & Christakis, 2008).

Thus, choosing college students as target group, this research seeks to determine the impact of menu labeling on food choices, especially calorie intake, by not only assessing the use of menu labeling, but also taking into account the influence of peers when dining in a university dining hall. To do so, a survey regarding social networks and calorie labeling was conducted to collect data at a dining hall at Arizona State University. Faculty, staff and visitors were also included to broaden the sample.

Research Objectives and Hypotheses

This study seeks to investigate the effects of menu labeling on calorie intake in relation to social network behavior. This study also intends to examine the relationship between obesity status and calorie intake by different demographic characteristics, how food consumers perceive the overall health value of foods consumed as well as whether calorie underestimation occurs when menu labeling is provided. An econometric model using data from the survey is used to test the following three hypotheses:

(1) Obese individuals dining together consume more calories compared to groups without obese individuals.
(2) Noticing and using menu labeling reduces the calorie intake from high-calorie foods and peer influence further amplifies these effects.
(3) Social interactions and the strength of tie in a particular group influence the amount of calories consumed.

The remainder of the thesis is as follows. The second chapter summarizes theoretical background on Body Mass Index, dietary guidelines, menu labeling as well as social networks and social influence. The third chapter covers previous literature on calorie estimation, menu labeling on food choice and social network influence on food choice and eating behavior. The fourth chapter introduces the study design and the method of data collection. In the fifth chapter empirical results are presented. The last chapter provides conclusions.

BACKGROUND INFORMATION

Healthy Weight, Overweight, Obesity and Body Mass Index

The World Health Organization (WHO) has defined health as "a state of complete physical, mental and social well-being" since 1948. Being of good health undoubtedly leads to wellness and quality of life. Achieving and maintaining a healthy body weight benefits people's overall health in many ways. First, people who sustain an appropriate weight look best, feel best and are full of energy and confidence for life. Second, the risk for developing health problems can be lowered by maintaining a healthy weight (Duyff, 2012). Third, maintaining a healthy weight helps avoiding the discrimination stemming from overweight or obesity (Puhl & Brownell, 2001). In order to pursue an overall healthy lifestyle, people are showing increasing concerns towards body weight. Before setting up any target weight, individuals need to understand a few important definitions related to weight issues, including underweight, healthy weight, overweight and obese weight.

Healthy weight, sometimes called normal weight or ideal weight, is a weight which is most suitable for a person's body size but not the lowest weight one may think (Duyff, 2012). In other words, healthy weight varies among individuals in terms of differing gender, age and body size. Duyff (2012) and Meisler & St. Jeor (1996) discuss that healthy weight is a range that is statistically associated to some health index, such as lower mortality, morbidity, and disease onset. In this context, any range above (overweight or obese) or below (underweight) a healthy weight range may be at risk of a less-than-healthy condition or even diseases related to body weight (Duyff, 2012). Body

mass index (BMI) is one of the most popular tools to measure the healthy weight range by involving weight and height. USDA & USDHHS (2010) confirms that BMI is a useful indicator to estimate individual body weight status. Table 1 indicates four weight categories: underweight, healthy weight, overweight and obese, that can be quantitatively specified in terms of different ranges of BMI. The calculation of BMI can be formulated as follows:

$$\text{BMI} = \text{weight (lbs)} \div \text{height (in.)} \div \text{height (in.)} \times 703$$

Or

$$\text{BMI} = \text{weight (kg)} \div \text{height (m)} \div \text{height (m)}$$

Source: Center for Disease Control and Prevention

Table 1

BMI categories

Category	Adults (BMI)
Underweight	Less than 18.5
Healthy weight	18.5 to 24.9
Overweight	25.0 to 29.9
Obese	30.0 or greater

Source: Center for Disease Control and Prevention

Dietary Guidelines

Calorie balance, which refers to a dynamically balanced relationship between calorie-intake and calorie expenditure over time, is "a key to maintain a healthy weight" (USDA & USDAHHS, 2010). Foods and beverages are the source of calorie consumption which can be expended during metabolic processes or through physical activities. Since metabolic processes cannot be controlled at will, achieving calorie

balance ultimately relies on the management of dietary intake and physical activity. Calorie needs vary across different age, gender, and physical activity levels (USDA and USDAHHS, 2010). On the basis of average estimated amounts of calories needed (USDA and USDAHHS, 2010), individuals can set a daily dietary intake and physical activity to promote calorie balance and to manage weight. Limited by lunch occasion and dining hall settings, this research exclusively focuses on investigating dining hall patrons' calorie consumption for lunch. Total daily calorie needs as well as physical activity are not included in the analysis.

Menu Labeling

According to public information (revised in 2009) released by Declare Health and Social Service, menu labeling is officially defined as the listing of nutrition information displayed on menus and menu boards in restaurants. The legislation of menu labeling was executed by several states and cities. The first menu labeling law passed by New York City in 2006 requires that restaurants with 15 or more locations must post nutrition information both on menu boards and menus. Following the steps of New York City, a number of cities in California and Massachusetts started to enact a mandatory menu labeling law for fast food restaurants (Blumenthal & Volpp, 2010; Nestle, 2010; Swartz et al., 2011). The Patient Protection and Affordable Care Act passed by Congress in 2010 included a national menu labeling law which required that all chain restaurants with 20 or more outlets must provide calorie information on all menus (Nestle, 2010; Swartz et al., 2011). Following the chain restaurants, more settings, like cafeterias in government, company buildings, hospitals and state universities provided menu labeling to let

consumers access nutrition information. In this study, a university dining hall was chosen as research location because the majority of foods there have posted nutrition information.

Social Networks Analysis

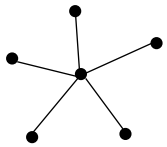
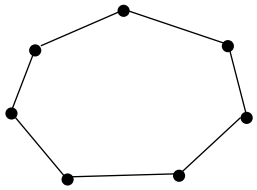
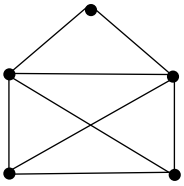
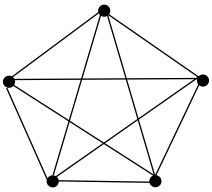
People are always involved in a certain social context which plays an important role in influencing their attitudes and behaviors. The individuals in the social context can be a person, group, organization and community. Wasserman & Faust (1994) explicitly indicate that social networks are a set of nodes (actors) that are tied by one or multiple relationships. In general, a social network is a mapping structure or description which demonstrates the patterns of the relationship among individuals in the group by means of nodes (actors), and links (ties). Nodes are actors or objects within the networks which represent individuals, organization, or even countries (Wasserman & Faust, 1994; Opsahl et al., 2010). Ties or links are the relationship between the actors which include friendship, value, beliefs, information, conflict or trade (Granovetter, 1973; Opsahl et al., 2010). Social network analysis focuses on exploring the pattern (position, relation and importance) formed by the nodes and links mathematically and visually in order to analyze their effects on individuals and the whole network (Scott & Carrington, 2011). Regarding the subjective of social network analysis, Scott & Carrington (2011) emphasize that social network analysis aims at (1) analyzing the relations between actors instead of attributes within the individual actor, which means that any similar outcomes of the individual actors should be analyzed with the context of social structure, (2) analyzing a network instead of groups, which means that all the nodes within a given

social network do not belong to any mutually exclusive groups and (3) analyzing the relations with the context of the whole network instead of between pairs.

Graph theory has been widely applied to social network analysis. Freeman (1978) and Wasserman & Faust (1994) and Grebitus (2008) summarize several graphs of simple social networks in terms of nodes and lines so as to visually describe various patterns of social networks.

Table 2

Examples of the Basic Shape of Networks

Simple Graphs		
Star or Wheel	Circle	Chain
		
Complex Graphs		
Incomplete	Complete or All Channel	
		

Source: Adapted from Freeman (1978), Wasserman and Faust (1994), Grebitus (2008).

Social Influence and Social Proximity

One of the key issues in social network analysis is the study of social influence which focuses on exploring how the structure of social relations influences the attitudes

and behaviors of the actors within a particular network (Marsden & Friedkin, 1993). Social proximity, which is linked with interpersonal influence between the actors in a network, has been employed as "a distinctive approach to social influence" (Marsden & Friedkin, 1993). From the perspective of social proximity, a social network can be regarded as "a channel of communication or diffusion" (Alba & Kadushin, 1976) in which information related to attitudes and behaviors is processed between the actors (Marsden & Friedkin, 1993).

In addition, Marsden & Friedkin (1993) summarize that social influence may occur under two circumstances, say, *behavioral contagion*, which means that within a group the behavior of actor A may spontaneously influence the behavior of actor B even though they didn't intentionally communicate with each other, and *direct influence,* which means that the initial actor initiated the attitudes or the behaviors to intentionally influence another member of the group (Lippitt et al., 1952). Two broad approaches have been adopted by social network analysis, *structural cohesion* and *equivalence* (Marsden & Friedkin, 1993). *Structural cohesion* can be used to measure social proximity by using the closeness (the intensity of ties) of the individual actors in the group. *Equivalence,* on the other hand, focuses on the similarity of actors in terms of the "actors" profile.

As far as this study is concerned, the information, an actor's food choice or obesity status, may either unintentionally influence another actor's food choice when they didn't communicate with each other regarding food choice or intentionally influence another member of the group by making positive or negative comments on the foods.

Degree Centrality

Freeman (1978) defined the degree of a focal node as the number of adjacent points to which a focal node is connected. Wasserman & Faust (1994), Freeman (2004), McPherson et al. (2001) and Opsahl et al. (2010) claimed that degree is a commonly used measure centrality and applicable for the preliminary study on social networks. Within a social network, an actor who has the highest degree definitely possesses situational opportunity or power (Ibarra & Andrew, 1993). From the standpoint of communication, the actor who has a relatively high degree centrality is "a focal point of communication" or "a major channel of information" (Freeman, 1978). On the basis of the degree centrality measurement in Freeman (1978), Opsahl et al. (2010) formalized this measure as:

$$C_D(i) = \sum_j^N x_{ij} \qquad (1)$$

where $C_D(i)$ = degree centrality of the focal node i,

N = the total number of nodes in the network,

j = all other nodes, and x is the adjacency matrix.

and x_{ij} = 1 if and only if node i and node j are connected by one line

x_{ij} = 0, otherwise

Relying solely on degree centrality of the focal node in social network analysis may overlook the important role played by the nodes with small degree but stronger ties

(Barrat et al., 2004). Barrat et al., 2004, Newman (2004), Opsahl et al. (2008) developed degree centrality within the context of weighted networks. Opsahl et al. (2010) formalized this measure as:

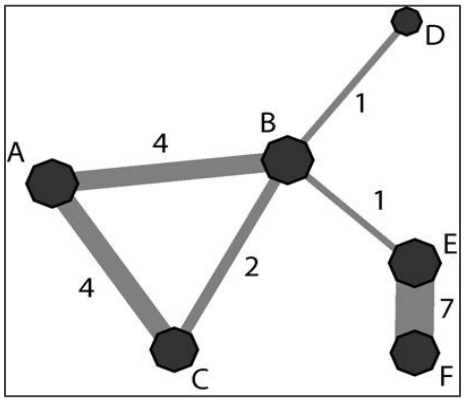
$$C_D^W(i) = \sum_j^N w_{ij} \qquad (2)$$

where w is the weighted adjacency matrix,

$w_{ij} > 0$ if the node i is connected to the node j,

and the value of w_{ij} depends on the weight of the tie. Figure 1 depicts a weighted network.

Figure-1, A Network with 6 Nodes and 6 Weighted Edges.



Source: Adapted from Opsahl et al (2010)

Figure 1 demonstrates how the combination of both degree centrality and weighed ties measure the involvement of nodes in a network. Node *B* was playing an important role in this network because Node *B* has not only the highest degree (4) among all the nodes in the network but also have the same strength (4) with node *A*. Thus,

incorporating both degree centrality and weighted ties into the study of social networks can help the researchers more thoroughly to measure an actor's involvement in the network.

In addition, all these food-related interactions in a network are a kind of information exchange (Haythornthwaite, 1996). In-degree and out-degree of the actors (nodes) generated from these directed matrix data can be used to determine how incoming and outgoing information flows occur in one individual group (Braha & Bar-Yam, 2004). In a directed network, the in-degree of a node reflects the number of adjacent nodes to that given node or the number of ties that given node received. The out-degree of a node is defined by the number of adjacent nodes from that given node or the number of nodes that given node is connected to (Hanneman & Riddle, 2009; Braha & Bar-Yam, 2004). In a network, the node with high in-degree is *prominent* in the network and the node with high out-degree is considered an *influential* actor (Hanneman & Riddle, 2009).

Strength of Ties

Depending on how the nodes are linked, the relationships behind the ties may vary in different social network settings. The notion of tie-strength is a quantifiable concept which characterizes the link between two nodes (Petroczi et al., 2007). Granovetter (1973) intuitively defined the strength of interpersonal tie as "the combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal service, which characterize the tie." Correspondingly, four

components in Granovetter (1973) can be measured by four indicators which are closeness, duration and frequency, breadth of topics and mutual confiding (Petroczi et al., 2007). Marsden & Campbell (1984) explain these four components can be measured by some methodologies. (1) Closeness is a strong indicator which can measure the intensity of the relationships; (2) duration and frequency of contact measures the amount of time spent on a tie involved; (3) both breadth of topics and mutual confiding measure the intimacy of the relationship. In this thesis, two indicators, closeness and contact frequency, are applied to analyze social networks because these two indicators are more relevant to social contacts during the lunch time than breadth of topics and mutual confiding.

LITERATURE REVIEW

Individual Calorie Estimation

Overeating away-from-home foods caused by calorie underestimation has been largely linked to the epidemic of overweight and obesity. Several studies reveal that food consumers often underestimate the calories when eating at a restaurant. Backstrand et al. (1997) concludes that even trained nutritionists often underestimate the calories of common food items. An experiment by Burton et al. (2006) indicates that participants consistently underestimate the calories of given menu items, especially for less-healthful items, such as "Fettuccine Alfredo, Hamburger and French fries and items alike". Both Chandon & Wansink (2007a) and Nestle (2003) agree that portion size is a hurdle for accurate calorie estimation. Health claims made by healthier fast food meals may lead consumers to underestimate the number of calories in their dishes and instead order high-calorie side dishes, drinks, and desserts (Chandon & Wansink, 2007b). In addition, Berman & Lavizzo-Mourey (2008) consider the calorie underestimation a psychological phenomenon termed "optimistic bias" which influences the individual's understanding and attitude towards calorie-related food consumption. Thus, determining calorie estimation is an important element in diet-related research and will thus be included in the survey of this thesis.

Menu Labeling and Food Choice

In order to address the issue of obesity which is to a large extent attributed to calorie underestimation, menu labeling has been proposed as a policy solution to guide

individuals towards healthy food choice by disclosing accurate nutrition information (Holdsworth & Haslam, 1998). Nestle (2010) asserts that menu labeling eventually will become a nationwide legislation for all chain restaurants. Though making any choices ends up with personal responsibility, the consumer has the right to receive accurate information which may significantly lead to more informed choices. Several studies discuss that most restaurant patrons and the general public want restaurant or other food providers to provide nutrition information. Bleich & Pollack (2010) reports 76% of a representative adult American sample thought calorie information is somewhat useful in making low-calorie choices. Piron et al. (2010) indicate that 84% of patients interviewed by a public health clinic considered menu labeling important and 86% of this sample supported the legislation of menu labeling. Dumanovsky et al. (2010), Elbel et al. (2009) and Krieger et al. (2013) examine consumers' awareness of calorie information after the enforcement of mandatory menu labeling and found out that more than half of the respondents reported seeing and using calorie information. In addition, Liu et al. (2012), Roberto et al. (2010) and Elbel (2011) indicate that food consumers exposed to calorie information could estimate the number of calories more accurately than those who lack the calorie information. Therefore, as a policy tool, menu labeling has widely and increasingly received acceptance and awareness from the public.

Fruitful studies have been conducted to measure and evaluate the impact of calorie labeling on food choice. Five studies (Yamamoto et al., 2005; Balfour et al., 1996; Cinciripini et al., 1984; Milich et al., 1976 and Burton et al., 2006), reviewed by Harnack & French (2008) show weak and inconsistent effects of menu labeling on restaurant and

cafeteria food choices. Both Cinciripini et al. (1984) and Yamamoto et al. (2005) observe the change of choosing food items from high calorie to low calorie after calorie information was presented. Both Milich et al. (1976) and Balfour et al. (1996) report apparent but inconsistent decrease in calories purchased after calorie labeling was implemented. Burton et al. (2006) discuss consumers' purchase intention may change from high calorie food to low calorie food when menu labeling was provided. Furthermore, Swartz et al. (2011) reviews five recent studies (Chu et al., 2009; Elbel et al., 2009; Dumanovsky et al., 2010; Elbel et al., 2011 and Finkelstein et al., 2011) which all focus on examining the relationship between menu labeling and calorie ordering and purchasing in chain restaurant and university dining hall settings. Among these five recent studies, Chu et al. (2009) conducted a study in a college dining hall. They report that the calories per entrée sold decreased (12.4 calories) statistically significant but not physically significant after posting calorie information. Dumanovsky et al. (2011) observe a decrease in mean calories purchased in some but not all chain restaurants after the menu labeling legislation took effect in New York City. Elbel et al. (2009) and Elbel et al. (2011) do not find out significant effects of calorie information on calories purchased. Finkelstein et al. (2011) even report the calories purchased increased after posting menu labeling.

Generally, previous studies measure the effect of calorie labeling on food choice by comparing two conditions, lack of menu labeling versus menu labeling. Apart from the methodological flaws, one reason why these studies only obtain weak and inconsistent results is that in restaurant and cafeteria settings, the effects of many other

factors may dilute the exclusive effect of menu labeling on consumers' food choice. For example, the findings of Elbel et al. (2011) confirm that taste is the most important factor for restaurant and cafeteria patrons when choosing a meal. Glanz et al. (1998) discuss that Americans' food consumption is influenced by taste, nutrition, cost, convenience, and weight control concerns.

Peer Effects and Food Choice

Larson & Story (2009) overview a few studies regarding social and peer networks influence on food choice and eating behavior. Several studies reveal that social networks are significantly associated with the consumption of fruit and vegetables (Steptoe et al., 2004; Sorensen et al., 2007; Emmons et al., 2007). Salvy et al. (2008) find out that even when unfamiliar peers are presented, overweight children ate more snack foods and both normal-weight and overweight children chose healthy snacks. Herman et al. (2003) normatively interpret three peer effects on eating behavior in terms of energy intake, including Social Facilitation – people tend to eat more in groups than eating alone, Modeling - people tend to eat as much as peers eat as well as Impression Management - people eat less than eat alone to react the evaluation from the peers. The effects of peers on eating behavior actually differ cross different BMI categories. The results of Salvy et al., (2008) indicate that overweight school-aged children consumed more calories alone than in groups due to impression management and normal-weight children consumed fewer calories alone than in groups due to social facilitation. On the other hand, several findings suggest the relationship between the individual's risk for obesity and social network. Christakis & Fowler (2007) find out that an individual's chance of being obese

increases more than 50% if his or her friends became obese using 32 years' data from the Framingham Heart Study. The perception was supported by the results of Trogdon et al. (2008) that there is a positive relationship between the BMI of an individual adolescent and the BMI of his or her friends. After examining Christakis & Fowler (2007)'s specification and dataset, Cohen-Cole & Fletcher (2008), however, argue that obesity is spread through contextual effects (environmental factors) instead of endogenous effects (social network effects).

METHODS

Study Design

In this research, a field survey approved by the Institutional Review Board of Arizona State University was conducted in the Citrus Dining Pavilion on the Polytechnic Campus of Arizona State University from January 29th, 2014 to February 5th, 2014. The Citrus Dining Pavilion is an all-you-can-eat buffet style university dining hall where a variety of foods are provided by many different food stations including: Mongolian BBQ, Deli (sandwiches and wraps), Pizza (pizza and pasta), Sizzles (hamburgers, sandwiches, hot dog, and French fries), Home Zone (comfort foods), Salad Bar (prepared salads and self-help salads) plus Action Station, Desserts, Cereal and Milk and Beverages (soda, juice, coffee, etc.). The dining hall posts calorie information as well as detailed nutrition facts for a majority of food items both on the counter and on monitors above the counters. The patrons of the dining hall are composed of students, faculty, staff and visitors who can purchase single meals by paying a premium price or using ASU meal plans. A total of 112 patrons were interviewed using a written questionnaire. In order to identify the relationship and interaction between peers, this field survey was conducted with groups of patrons who dine together at the dining hall. Four members of each group were interviewed at the same time for a total of 28 groups. The whole survey lasted 10 to 15 minutes and each participant was offered a 5 dollar gift card of the Citrus Dining Pavilion for the compensation of their time. Each participant was given a number which was linked to the questionnaire to ensure confidentiality.

Questionnaire

As an instrument of data collection, the questionnaire consisted of four parts. The first part aims at analyzing the relationship and interaction of the interviewed groups dining lunch. The questions mainly regarded the group members who were dining together (e.g., how often they contact each other, how well they know each other, how often they have lunch together, and how they interact with each other during lunch).

The second part focused on the patrons' food choice. The questions covered the factors influencing food choices, the patrons' preference for the foods from different food stations, the attention on menu labeling as well as the perception of nutrition ingredients on labels.

The third part involved the patrons' calorie intake and calorie estimation. All the foods consumed for lunch by each participant were reported via a food check list and total calories were calculated afterwards. Calorie estimation analysis included the estimation of total calories and single meal calories.

The final part was concerned with demographic information including: age, gender, education, income, ethnicity, status (student, faculty, staff, and visitor), self-reported weight and height to define BMI, as well as the frequency of eating away from home. Throughout the questionnaire, all the questions related to frequency are consistent with an ordinal scale (less than monthly, monthly, a few times a month, weekly, a few times a week, and daily). In addition, participants were required to indicate the exact cost of their lunch and meal plan information.

Data Collection for Calorie Intake

The data collection for calorie intake included a daily updated food check list which covered almost all foods offered by different food stations. The participants were required to specify the units of all the foods they ordered for lunch on the check list. The size of unit varied by different foods and different food utensils. Some foods are served in a standard serving size by the staff based on their working protocol. For example, one slice of Philly beef steak from the Mongolian BBQ station is about 3 ounces; creamy tuna salad from the Deli Station is provided in a portion size of ½ cup every time; pizza is evenly divided into 1/12 cut per slice; comfort foods from the Home Zone Station are always served for one serving size without exact measure unit. Some foods have to be taken by using a standard size food utensil even though the customers have to serve themselves. For instance, each container for Mongolian BBQ sauces and salad dressings is equipped with a little spoon of one fluid ounce; a big spoon of 8 fluid ounces is used to scoop soup at the Soup station; the cup for soft drink and the mug for coffee are 12 fluid ounces and 8 fluid ounces, respectively. The unit for those foods which are completely self-served without a quantifiable food utensil can only be represented with “a little” and “a lot”. This kind of food includes the French fries at the Sizzle station, potato chips provided at the Deli station and vegetables and snacks at the Salad bar. (See Appendix-B for details)

Total calorie intake was calculated by summing up the calories of every single food item consumed during the lunch. The calories of one particular food are the multiplication of the number of units, which were reported by the respondents, and the

calories per unit, which were obtained from three sources in my research. First, the majority of foods offered by the Citrus Dining Pavilion have posted calorie information on the counters for the day and on the ASU dining department website three weeks in advance. Second, the unit calories for branded foods like bread, cereal, and beverage, can be looked up either from their package label or from the manufacturers' official website. Third, the average unit calories of the foods which are neither on the menu labeling nor branded foods, like desserts, vegetable, and fruits, are sourced from the National Nutrition Database from USDA ERS. As for foods which are only shown in units as "a little" or "a lot" on the check list, vegetable offered at the Salad Bar is set as one ounce for "a little" and two ounce for "a lot", the snacks from the Salad Bar, like raisins, rice crackers and croutons are set as half an ounce for "a little" and one ounce for "a lot", and potato chips from the Deli station and French fries from the Sizzle station, is half a serving size for "a little" and one serving size for "a lot" for being able to calculate the calorie intake.

Social Network Analysis: Contact Frequency, Closeness and Strength of Ties

In order to learn about the relationships between dining hall patrons, we asked participants to (1) indicate how often they contact each other through four common channels, social network website, e-mail/texting, phone call/online call and face-to-face meeting (Berg et al., 2012) on a 6-point ordinal scale with 0= less than monthly, 1=monthly, 2= a few times a month, 3=weekly, 4=a few times a week, and 5=daily; (2) indicate how to describe the relationship with other 3 members on a 5-point ordinal scale of relationship categories with 1=meeting for the first time, 2=acquaintance, 3=a friend or

kinship, 4=a good friend or kinship, and 5=a close friend and kinship (Marsden & Campbell, 1984); (3) indicate how often they dine together at lunch time on a 6-point ordinal scale which is consistent with the frequency scale of general contact abovementioned.

Berg et al. (2012) found out that there are positive relationships between different contact frequency models and concluded that different contact channels are complementary instead of substitutionary in terms of the contribution to strength of ties. Marsden & Campbell (1984) concluded that the closeness (intensity of the relationship) is the best indicator of tie-strength. Therefore, the strength of ties was generated by summing up scale numbers for four contact frequencies between the respective group members and multiplying the summation with the corresponding scale number of closeness (weighted). The strength of lunch ties was calculated by further multiplying the weighted strength of ties with lunch frequency. Using Ucinet software, social network graphs generated can visually and explicitly present the relationship between members in every singly group (see Appendix-C for all social network graphs of 28 interviewed groups). In addition, all matrix data related to social networks, including the strength of general ties, the strength of lunch ties, and degree centrality analysis, were analyzed using Ucinet 6 version 6.507 for Windows.

Analysis of Menu Labeling and Food Choice

To determine the relationship between menu labeling and food choice, this study investigates a few aspects by use of questionnaire. First, the preference for the individual

food stations was examined by asking "How much do you like the food from each food stations on a 5-point scale from 1 (do not like it) to 5 (like it very much)". Second, the question "Please choose the three most important factors on the following list that influence your food choice at the Citrus Dining Hall." adapted from Poovey (2008) was asked to examine a variety of factors that patrons link to their food choice. Third, in order to further examine the influence of menu labeling on food choice, the question whether patrons pay attention to and use calorie information was provided to the participants. Fourth, since menu labeling usually displays a few nutrition facts (e.g., calories, protein, carbohydrate, sugar and etc.), the question which nutrition facts patrons usually pay attention to when referring to menu labels was asked to investigate patrons' awareness of detailed nutrition facts on menu labels.

Analysis of Calorie Intake and Calorie Estimation

To test the hypothesis that menu labeling and peer groups affect calorie intake and therewith weight increase, participants were required to provide detailed information on the food they consumed at the dining hall by filling out a check list in the questionnaire. Since the foods offered by ten different food stations are more or less related to healthy option (e.g., healthy foods at Salad bar versus unhealthy food at Sizzles), total calorie intake was broken down into 10 categories based on where the foods provided. In addition, in order to evaluate people's perception on healthy eating, participants were also asked to indicate how healthy the overall lunch was on a 10-point scale from 1=very unhealthy to 10=very healthy. Then perceived health values were categorized into two

groups which consist of healthy with range from 6 to 10 and less than healthy with range from 1 to 5.

To analyze the links between calorie intake and issues such as perception of healthy eating, BMI, and menu labeling, the amount of total calories consumed for lunch was divided into four categories using the mean value of 787.80 kcal, the maximum amount of calories consumed (2,576.91 kcal) and the standard deviation of 442.61 kcal. The first category ranges from 0 and 345.19 kcal which is the difference between the mean value and standard deviation. The second category ranges from 345.20 kcal to 787.80 kcal. The third category ranges from 787.81 kcal to 1,230.41 kcal, which is the summation of the mean value and the standard deviation. Finally, the fourth category ranges from 1,230.42 kcal to 2,576.91 kcal.

In this study, seven representative meals were chosen to determine participants' calorie estimation. The estimate calories data were collected by asking participants to estimate the individual meal based on their experience and current knowledge. The objective calories were calculated by given unites and calories per unit in Appendix-B. By following the method of Burton et al. (2006), the difference between estimated calories and objective calories determined the property of estimation, e.g., a positive difference is overestimation and negative difference is underestimation.

Analysis of Interactions during the Lunch

In order to determine intentional social influence on peers' attitudes and behavior during lunch, a series of questions was asked to be answered as "true" or "false" so as to

examine food-related interactions between each other in a network. The questions consist of "Whether the individual noticed the food other group members ordered" and "Whether they talked about the food, recommended it and ultimately ordered the same food their peers ordered". To cover the entire process of the interactions, eight questions were categorized into two stages, initial order and after initial order, because the patrons are allowed to take the food as many times as they want in the Citrus Dining Hall. For instance, the question "I talked to him or her about the food before I initially ordered mine" and the question "I talked to him or her about the food while eating together" can distinguish two stages of food-related interactions.

In addition, Manski (1993) proposed that the correlation between actions of the individual in a group is caused by three effects, endogenous, exogenous, or contextual effects. Among these three effects, only endogenous effects are defined as the determinants of the changes of individual behavior via the change of group behavior (Manski, 1993; Plonter, 2013). In this study, exogenous effects may exist between obese peers who choose their social community only based on weight. Contextual effects are linked to all dining environment in a dining hall. With the presence of exogenous effects and contextual effects, Endogenous effects can be identified using peers' observed outcome (Manski, 2000; Plonter, 2013). The questions "I noticed what food he or she ordered before I ordered mine", "I noticed what food he or she ordered while eating together", "I ordered the same foods as his or hers at initial order" and "I go back to order the same foods as his or hers later" were designed to determine peers' observed lunch choices in a group.

Econometric Analysis: Tobit Model

In this thesis, a tobit model is utilized to test three hypotheses: The calorie consumption of an individual in a group will be influenced by a) the obesity status of peers, b) the nutrition facts posted on menu, and c) the social interactions and the strength of ties with peers. As far as total calorie intake is concerned, the total calorie consumption of an individual ranges from a minimum amount of calories (greater than zero) to a maximum amount of calories. From the viewpoint of calorie intake from different food stations, the calorie consumption of an individual from any food stations ranges from zero to a maximum amount of calories. Thus, the tobit model is applicable for the truncated calorie data using a lower bound and an upper bound. The independent variables in the tobit model are determined in the following paragraphs.

First of all, social influence is termed that one actor's attitude and behavior may spontaneously or intentionally affect other members' attitudes and behaviors through the channel of social networks (Lippitt et al., 1952). On the one hand, this study assumes that one individual's obesity status spontaneously or potentially affects a peer's attitude and behavior because obese peers may change one individual's attitude towards being obese or may directly influence eating behavior (e.g., food choices) which is largely related to weight control (Cohen-Cole & Fletcher, 2008). Christakis & Fowler (2007) apply obesity status of "Ego" (one individual) to estimate the obesity status of "Alter" (a friend, spouse or relatives) at a given time. Following the method of Christakis & Fowler (2007), this study uses two dummy variables "Ego obese" and "Peer obese", both of which are developed from participants' BMI. Within each group, "Ego obese" is defined

as 1 if an individual's BMI is greater than 30 and 0 otherwise. Each corresponding "Peer obese" is defined as 1 if at least one of the group members is obese (BMI>=30). If only one individual is obese, to avoid the occurrence of the reflection problem[1], corresponding "Peer obese" equals 0 and the other three "Peer obese" equal 1.

This study also assumes that menu labeling may indirectly influence peers' food choices by influencing those participants who noticed and used menu labeling. Again following the method of Christakis & Fowler (2007), this study constructed two more dummy variables "Ego label" and "Peer label". The first one equals 1 if the individual noticed the menu labels, the latter equals to 1 if at least two of the group members stated to notice the calorie labels. If only one individual reported noticing the menu labels, again, corresponding "Peer Label" equals 0 and other three "Peer label" equal 1.

In addition, the directed interactions during the lunch are measured using in-degree and out-degree of the individual in a group. The data of in-degree and out-degree were derived from the matrix data of the interactions for each group by conducting the centrality analysis in Ucinet software.

To sum it up, combined with all the independent variables discussed above, the tobit model is formulated as below.

$$C^* = \beta_0 + X_D\beta_1 + x_{Obese}^{Ego}\beta_2 + x_{Obese}^{Peer}\beta_3 + x_{Label}^{Ego}\beta_4 + x_{Label}^{Peer}\beta_5 + x_{Ii}^{ID}\beta_6 + x_{Ii}^{OD}\beta_7 + \varepsilon \qquad (3)$$

[1] "Reflection problem" initially described by Manski (1993). In social network analysis, a reflection problem occurs if researchers infer the effect of the group behavior on the behavior of an individual that comprise the group.

where C^* is the amount of calorie consumption, β_0 is the intercept term, X_D is a vector of the demographic characteristics of the sample, such as, age, gender and etc., x_{Obese}^{Ego} and x_{Obese}^{Peer} are two dummy variables "Ego Obese" and "Peer Obese", respectively, x_{Label}^{Ego} and x_{Label}^{Peer} represent two dummy variables "Ego Label" and "Peer Label", respectively, x_{Ii}^{ID} and x_{Ii}^{OD} represent the in-degree and the out-degree of i interactions (i = 1, 2, 3,…, N), respectively, β_1 to β_7 are the unknown parameters for the independent variables. ε is the error term. For the total calorie consumption, C^* has a range from the minimum of total calorie intake to the maximum of total calorie intake. For the calorie consumption from the individual food station, C^* ranges from 0 to the maximum of the calorie intake from the particular food station.

On the other hand, three dummy variables were constructed to specify the closeness, including "Eating with peers met for the first time", "Eating with peers who are acquaintances" and "Eating with at-least friend". The first one equals 1 if one individual dined with at least one first-time-meet peer in a group and 0 otherwise. The second one equals 1 if one individual dined with at least one acquaintance in a group and 0 otherwise. The third one equals 1 if one individual dined with at least one peer who is a friend or kinship, good friend or kinship or close friend or kinship and 0 otherwise. Therefore, the extended tobit model is formulated as below.

$$C^* = \beta_0 + X_D\beta_1 + x_{Obese}^{Ego}\beta_2 + x_{Obese}^{Peer}\beta_3 + x_{Label}^{Ego}\beta_4 + x_{Label}^{Peer}\beta_5 + x_{Ii}^{ID}\beta_6 + x_{Ii}^{OD}\beta_7 + x_{Close}^{1}\beta_8 + x_{Close}^{2}\beta_9 + x_{Close}^{3}\beta_{10} + \varepsilon \quad (4)$$

where three dummy variables, "Eating with peers met for the first time", "Eating with peers who are acquaintance" and "Eating with at-least friend" which are indicated as

x_{Close}^{1}, x_{Close}^{2}, and x_{Close}^{3}, respectively, are added to the tobit model. β_8, β_9, and β_{10} are the unknown parameters for these three variables, respectively.

Descriptive statistics and econometric models were analyzed using Small Stata 13.1 for Windows. Among the descriptive statistics, cross-tabulations were used in Small Stata 13.1 to compare the difference between two variables, for instance, age and BMI categories, menu labeling and gender, as well as calorie intake and perceived healthy value, etc.

EMPIRICAL RESULTS

Descriptive Statistics

Sample Characteristics

Table 3 summarizes the sample characteristics in this study. A total of 112 participants were interviewed in groups of four members. The majority of respondents (68%) were young adults between 18 and 24 years old. 14% of respondents were between 25 and 34 years old. The respondents between 35 and 45 years old and 46 years or above accounted for 9% of the respondents, respectively. The majority of the sample was students (69%), both staff and visitors accounted for 14% of the sample, respectively, 3% of the sample was faculty.

In addition, 63% of respondents paid for the lunch using a meal plan ranges from $5.50 to $7.50 for each depending on the plan purchased. 37% of respondents purchased the lunch at a premium price of about $9.50. Of the respondents who used the meal plan, 92% were students, only 7% and 1% of meal plan holders were staff and faculty, respectively, and no visitor in this sample had a meal plan. To sum up, most respondents in this study were college students between 18 and 24 years old with meal plan.

Male participants almost dominated the sample at 68%, females accounted for 32%. Though four statuses, student, faculty, staff and visitor, were included in the survey, the domination of a student sample reflects to a certain extent the gender ratio of students enrolled at ASU Polytechnic Campus (Student enrollment database for fall of 2012).

Table 3

Characteristics of the Study Sample

	%	No.
Gender		
Female	32%	36
Male	68%	76
Age		
18 to 24 years old	68%	75
25 to 34 years old	14%	16
35 to 45 years old	9%	10
46 years old or above	9%	10
Ethnicity		
White	60%	67
Hispanic	13%	14
Native American	2%	2
African American	4%	4
Asian/Pacific Islander	13%	14
Other	9%	10
Education		
High school diploma	29%	33
Some college	32%	36
Technical school diploma	1%	1
Associate's degree	4%	5
Bachelor's degree	17%	19
Master' degree	14%	16
Doctorate	2%	2
Patrons Source		
Student	69%	77
Faculty	3%	3
Staff	14%	16
Visitor	14%	16
Lunch Cost		
Meal Plan	63%	70
Student	92%	65
Faculty	1%	1
Staff	7%	4
Visitor	0	0
Premium Price	37%	21

With respect to education characteristics, 29% of the participants have high school diploma. 32% of the participants have some college education. The participants who have bachelor's degree and master's degree accounted for 17% and 14%, respectively. Technical school diploma (1%), associate's degree (4%) and doctorate (2%) represent the education level of the remaining share of participants.

In addition, the ethnical structure of the samples, White (60%), Hispanic (13%), Native American (2%), African American (4%), Asia/Pacific Islander (13%), and Other (9%), is to a large extent consistent with the ethnical structure of enrolled students at ASU Polytechnic Campus (student enrollment database for fall of 2012).

Table 4 describes the sample's BMI categories with regards to different demographic indicators. Overall, half of the respondents have a normal weight which is defined in the BMI range of 18.5 and 24.9. 46% of the respondents are overweight (24%) with a BMI range of 25 to 29.9 and obese (22%) with a BMI of equal or greater than 30, respectively. Only 4% of the respondents are underweight with a BMI of less than 18.5. With respect to BMI status, the majority of females (51%) and males (49%) have a normal weight. 48% of male participants are overweight and obese, which is proportionally higher than the overweight and obesity rate of female participants (41%). The results reflect to a certain extent U.S. adults' overweight and obesity rates by gender which are 69.9% of males and 57% of females by 2012 (CDC's BRFSS survey data, 2012).

As for BMI status in different ethnic groups, except for Native Americans, the majority of each of the other ethnic groups are within the range of normal weight (eg., 45% of White, 50% of Hispanic, 50% of African American, 71% of Asian/Pacific Islander and 67% of other race). Overweight and obesity rates for all ethnic groups in this sample are 100% for Native Americans, 52% for White, 50% for Hispanic, 50% for African Americans, 33% for other and only 14% for Asian/Pacific Islanders. The ranking order of overweight and obesity rates in this sample is consistent with the ranking order of overweight and obese rates for all U.S. adults by ethnicity (CDC's BRFSS survey data, 2012).

Referring to BMI status in different age groups, the majority, 59% of young adults with 18 to 24 years old have normal weight. Normal weight rates for the rest of the age groups is 40% for people at 46 years old or above, 31% for people between 25 and 34 years old and 23% for people between 35 and 45 years old. The age group between 35 and 45 years old ranks first in terms of overweight and obesity rate (77%). Overweight and obesity rates for the rest age groups are 69% for people between 25 to 34 years old, 50% for people at 46 years old or above and only 37% for people between 18 and 24 years old. 40% obesity rate for people at 46 years old or above in this sample is relatively consistent with the trend in the increasing obesity rate in older adults in the U.S. (Ogden et al., 2012)

In the following, BMI category is included in menu labeling, calorie intake as well as econometric analysis. Firstly, the influence of calorie labeling on dining hall patrons' food choice may vary across different BMI category. Correspondingly, total

calorie intake also may vary by different BMI category. As a result, the obesity may influence food choice and calorie intake through social network.

Table 4

Social Demographics vs. BMI Categories

		BMI Categories			
		Underweight (<18.5) (%)	Normal weight (18.5 - 24.9) (%)	Over weight (25 - 29.9) (%)	Obese (>=30) (%)
Total Sample		4%	50%	24%	22%
Gender					
	Female	6%	51%	20%	23%
	Male	3%	49%	27%	21%
Race					
	White	3%	45%	27%	25%
	Hispanic	0	50%	29%	21%
	Native American	0	0	100%	0
	African American	0	50%	25%	25%
	Asian/Pacific Islander	14%	71%	7%	7%
	Other	0	67%	11%	22%
Age					
	18 to 24 years old	4%	59%	20%	17%
	25 to 34 years old	0	31%	44%	25%
	35 to 45 years old	0	23%	44%	33%
	46 years old or above	10%	40%	10%	40%

Social Networks of University Dining Hall Patrons

Table 5 provides a snapshot for three important indicators, common contact frequency via four channels, dining frequency and closeness, in terms of mean value and standard deviation. Surprisingly, the results show that three indicators are very even on average concerning all the groups though they may differ a lot in an individual group. On average, the participants of groups meet face to face between weekly and a few times a week. Email/texting ranks second with an average frequency close to a few times a

month but the frequency via this way may vary a lot cross different groups due to the relative high standard deviations (up to 2.16). Compared to the top two channels, social network website and phone call/online calling are not very popular with an average frequency between monthly and a few times a month. The reason behind the results may be that most participants, especially students, often take in-person class together so that they would rather talk to each other face to face than communicate via social network website or phone call. With regards to dining frequency and closeness, on average, the participants have lunch together between a few times monthly and weekly, the participants considered each other a friend or kinship.

Table 5

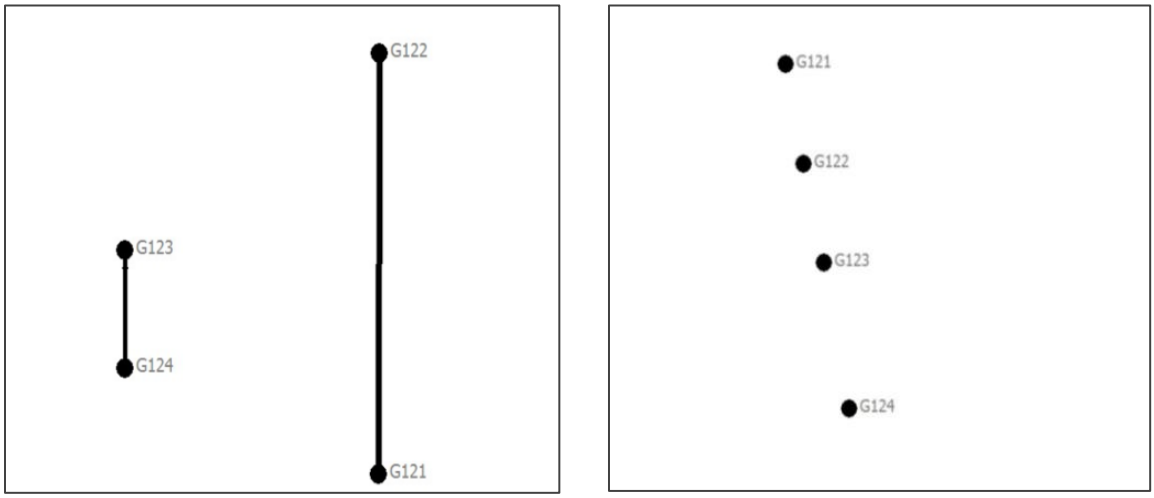
Contact Frequency via Four Channels, Dining Frequency, and Closeness

	Member 1		Member 2		Member 3		Member 4	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Common Contact Frequency								
Social Network Website	1.46	1.87	1.31	1.81	1.26	1.81	1.47	2.04
E-mail/Texting	2.44	2.07	2.21	2.16	2.14	2.15	2.30	2.12
Phone Call/Online Calling	1.64	1.95	1.52	1.92	1.51	1.99	1.86	2.04
Meet face-to-face	3.71	1.68	3.52	1.74	3.52	1.87	3.69	1.50
Dining Frequency	2.54	1.83	2.65	1.85	2.5	1.92	2.49	1.88
Closeness	3.33	1.35	3.26	1.25	3.17	1.29	3.29	1.22

Regarding social network graphs, the four sample groups shown are discussed in terms of graph shape, tie strength as well as degree centrality. The graph for strength of ties (left) in Figure 2a illustrates a simple graph of social networks. The relations between

two pairs of nodes (G121 and G122, G123 and G124) form two parallel lines. The strength of ties between G121 and G122 is slightly stronger than the strength of ties between G123 and G124. Since this chain-shape social network has relatively low strength of ties, the strength of lunch ties do not exist in Group 12. The right graph shows that four members in Group 12, on average, do not dine with each other during lunch time.

Figure-2a, Strength of Ties (left) vs. Strength of Lunch Ties (right) – Example Group 12



The graphs for strength of ties (right) in Figure 2b and Figure 2c present two types of incomplete complex graphs of social networks. In Figure 2b, the strength of ties between G51 and G52 is apparently quite stronger than the strength of ties with or between other nodes. In Figure 2c, the relations between G81, G82 and G84 are the strongest ties within Group 8. From the perspective of degree centrality, node G51 in Figure 2b is a three-degree focal point to which other three nodes are connected. In Figure 2c, each of G81 and G84 has 3 degrees and each of G82 and G83 has 2 degrees.

Though G82 and G83 have the same degree centrality, G82 is involved in Group 8 much more than G83 because the strength of G82 linked to G81 and G84 is stronger than the strength of G83 tied to them. After weighted into the strength of lunch ties, node G53 (Figure 2b) and node G83 (Figure 2c), which both have weaker tie-strength within respective group, are now excluded from the circle shape graph of lunch ties.

Figure-2b, Strength of Ties (left) vs. Strength of Lunch Ties (right) – Example Group 5

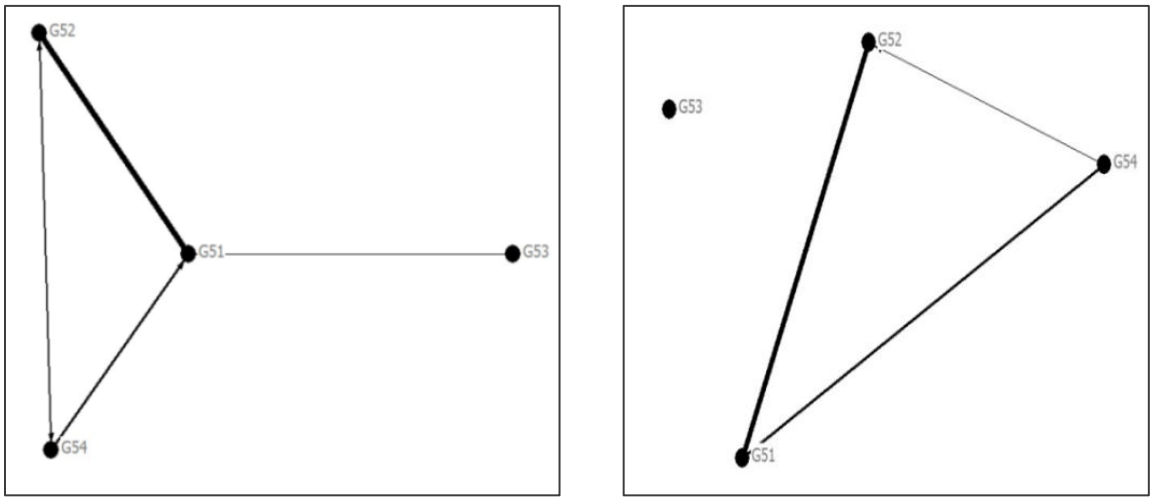
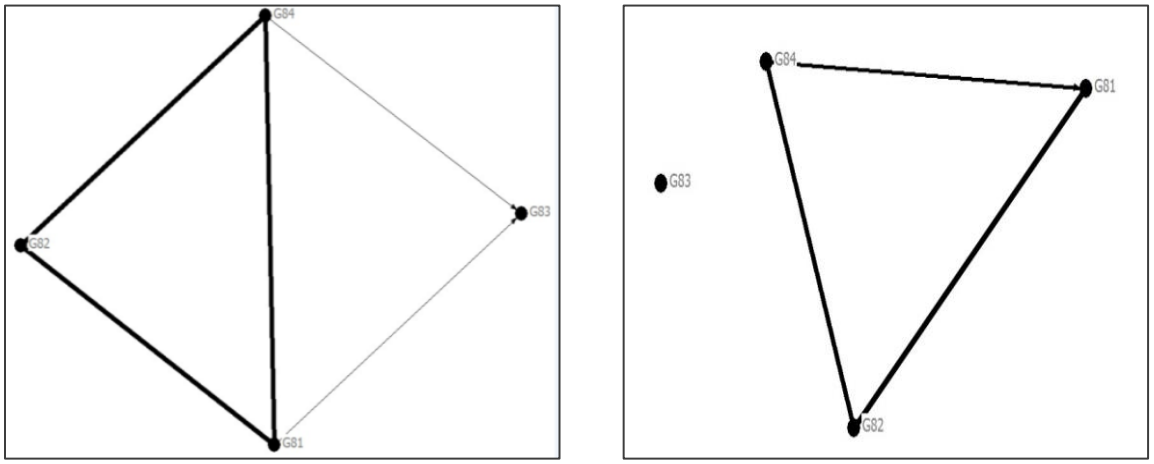
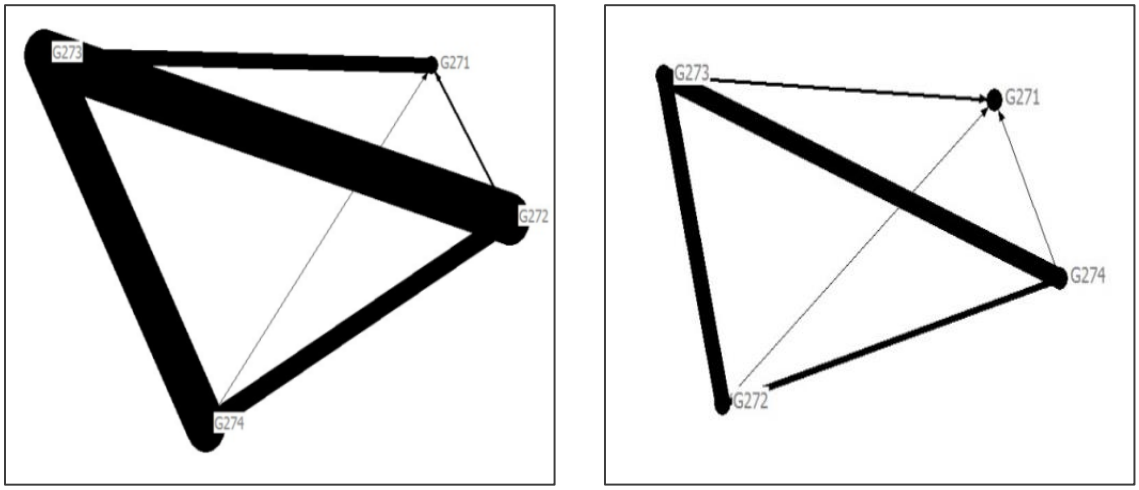


Figure-2c, Strength of Ties (left) vs. Strength of Lunch Ties (right) – Example Group 8



Sample Group 27 in Figure 2d exhibits a full channel/complete complex graph of social networks. The characteristics of this graph are that all the nodes are fully connected with each other and every node has the same degree centrality of (N-1) (N represents the total number of nodes in a network). In this regards, the strength of ties is utilized to measure each node's involvement in a full channel network. Take node G271 and node G273 in the left graph of Figure 2d for example, although they have the same degree centrality of 3, node G273 is more involved in Group 27 than node G271 because G273 was tied to each of G272 and G274 considerably stronger than G271 was. With respect to the strength of lunch ties (the left graph in Figure 2d), the graph shape as well as the characteristics of ties are proportionately consistent with those of strength of ties.

Figure-2d, Strength of ties (left) vs. Strength of lunch ties (right) – Example Group



Food Preference, Food Choice and Menu Labeling

Figure 3 provides overall preferences measured by the mean value of scale number for ten food stations of the Citrus Dining Hall. The top three food stations are

Beverage (4.0), Sizzle (3.8) and Salad Bar (3.7). The Beverage station provides the customers with various options, including soda, juice, coffee, and other beverages. The Sizzle station is offering various hamburgers, sandwiches, hot dogs and French fries which are similar to the foods offered by fast food chain. The Salad bar provides both prepared salads and self-help salads. The result reflect to some extent that most people still prefer the combination of their lunches to be like a combo meal offered by most fast food chain - hamburger, salad bowl and a soft drink. Compared to foods from the top three stations, Asian style foods from the Mongolian BBQ station (3.4) and comfort foods from the Home Zone station (3.4), both of which actually represent unique characteristics of dining hall, do not draw as much attention of respondents as expected. The preference mean values for other food stations (e.g., Deli, Pizza, Dessert, Cereal and Milk, Soup) range from 3.4 to 2.9. In general, the foods at Citrus Dining Hall are perceived positively.

Figure-3, Food Stations Preference (Mean Value)

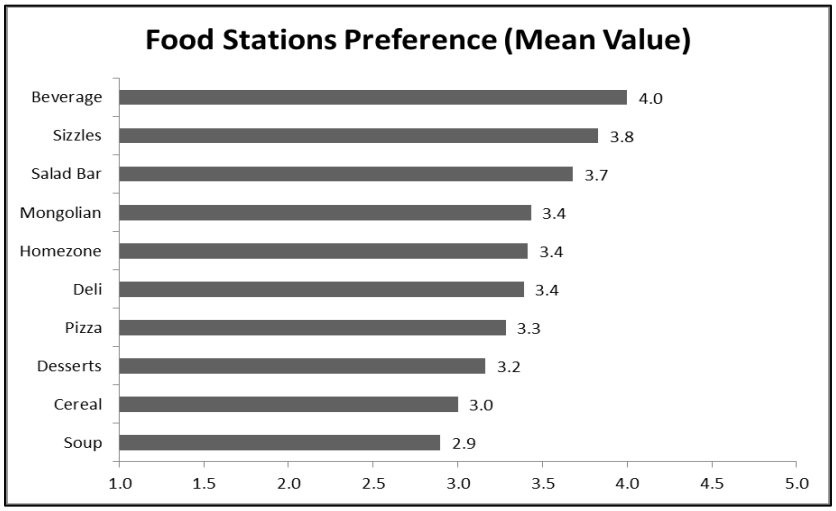
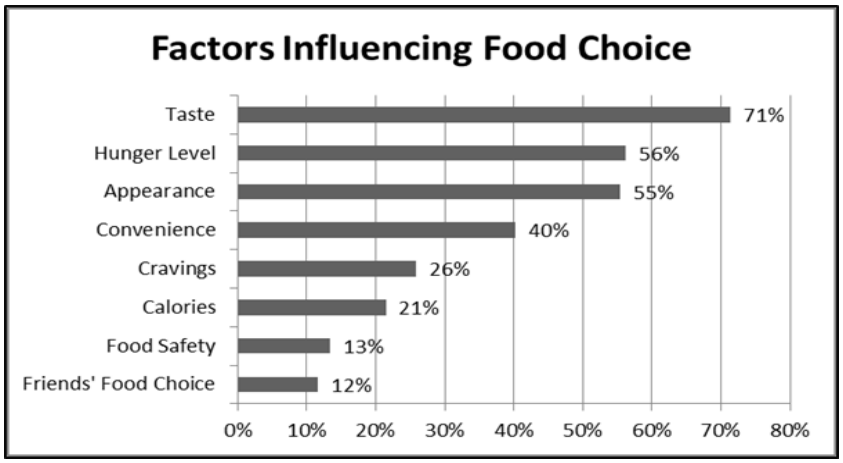


Figure-4, Factors Influencing Food Choice

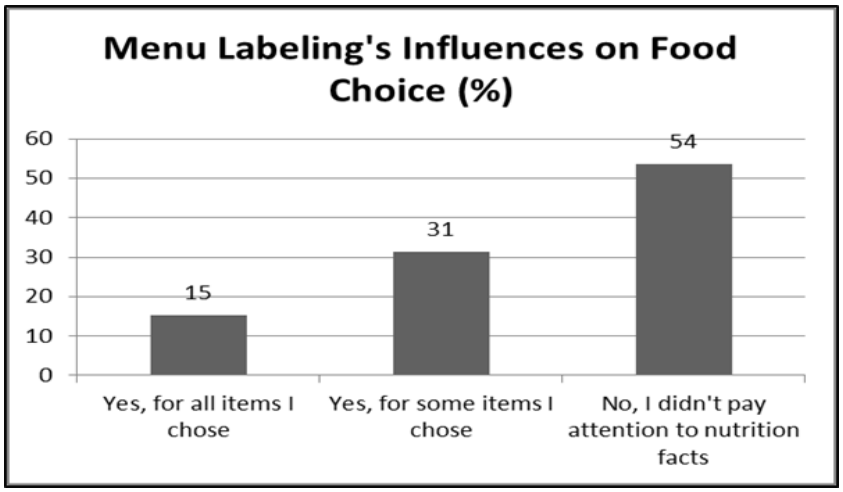


As Figure 4 shows, top three factors influencing the respondents' food choices are taste (71%), hunger level (56%) and appearance (55%), respectively. The results are to a large extent consistent with the findings of Poovey (2008) in which three most important factors were taste (70.1%), hunger level (57.6%) and appearance (48%). The rank order of other factors is convenience (40%), cravings (26%), calories (21%), food safety (13%) and friends' food choice (12%).

With regards to taste, Shepher & Raats (2006) determined that people largely rely on taste to develop their sensory perception of food and beverage so that taste becomes a key predictor of food consumption. Convenience, on the other hand, has been confirmed to one of the most important factors influencing food choice by Glanz et al. (1998). The All-you-can-eat buffet style dining hall is the most convenient food provider on campus in terms of the diversity of foods, the way foods served and the acceptance of meal plans. Compared to the top four factors discussed above, calories, food safety and friend's choice weren't considered to be very important factors by most respondents. In addition,

although cost/price is an essential factor influencing food choice (Glanz et al., 1998; French, 2003), cost may not matter so much for the patrons at the dining hall where food is only available for either meal plan or premium price.

Figure 5: Menu Labeling's Influences on Food Choice



As Figure 5 displays, 46% of participants did notice the nutrition facts. Of them, 31% of participant used the nutrition facts when choosing some of the items they ate. 15% of participant made their complete food choice based on the nutrition facts. The results are somewhat consistent with the findings that more than half restaurant patrons reported noticing calorie information (Krieger et al., 2013; Dumanovsky et al., 2010; Pulos et al., 2010; Elbel et al., 2009; Jensen et al., 2009).

It is hypothesized that the impact of calorie labeling on food choice may not be uniform depending on different factors. First, several studies asserted gender is largely linked to the effectiveness of calorie labeling. More females reported noticing and using calorie information than males (Bleich & Pollack, 2010; Krieger et al., 2013;

Avcibasioglu et al., 2011; Bates et al., 2009; Driskell et al., 2008). Second, the studies (Tandon et al., 2011; Tandon et al., 2010) were conducted to specify how age may differentiate the influence of nutrition labeling on food choice. Third, people may react to the calorie labeling when choosing specific menu items, especially high-calorie items (Burton et al., 2009). Furthermore, due to disproportionately high obesity rate cross ethnic groups in the U.S. (Flegal et al., 2010, Ogden et al., 2010), there is a need to examine how different ethnic groups and BMI respond to menu labeling when choosing restaurant foods.

Table 6

Social Demographic vs. Self-reported Menu labeling's Influences on Food Choice

	Self-reported menu labeling's Influences on food choice		
	Yes, for all items I chose (%)	Yes, for some items I chose (%)	No, I didn't even pay attention to nutrition facts (%)
Total Sample	15%	31%	54%
Gender			
Female	14%	42%	44%
Male	16%	26%	58%
Race			
White	13%	31%	55%
Hispanic	14%	43%	43%
Native American	0	0	100%
African American	0	25%	75%
Asian/Pacific Islander	14%	50%	36%
Other	30%	0	70%
Age			
18 to 24 years old	15%	24%	61%
25 to 34 years old	6%	56%	38%
35 to 45 years old	40%	30%	30%
46 years old or above	40%	50%	10%
BMI category			
Underweight (<18.5)	0	0	100%
Normal weight (18.5 to 24.9)	16%	38%	46%
Overweight (25 to 29.9)	11%	33%	56%
Obesity (>=30)	12%	21%	67%

Table 6 provides an overview on how the influence of menu labeling on food choice varies by gender, age, race, and BMI categories using cross tables. Regarding gender, although more males than females were interviewed in this study, a higher proportion of females (56%) stated noticing and using menu label than the proportion of males (42%). As for ethnicity, 64% of Asians/Pacific Islanders 57% of Hispanics, 44% of Whites reported seeing and using the menu labeling for both some menu items and all the foods ordered. Only 30% of other races and 25% of African Americans did so. None of the Native Americans even noticed the nutrition facts at all.

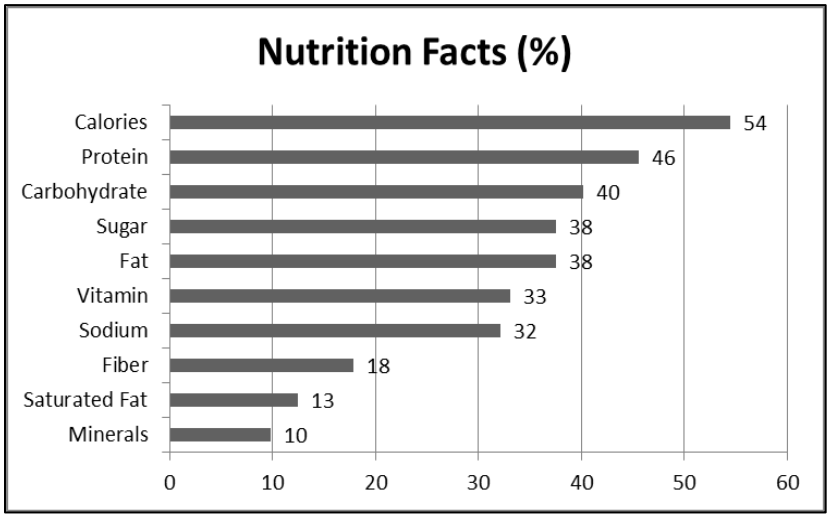
With regards to age, the results apparently suggest that the effectiveness of calorie labeling is gradually strengthened with the increase in age. Compared to respondents between 18 to 24 years old (39%), 90% of respondents above 46 years old, 70% of respondents between 35 to 45 years old, and 62% of respondents between 25 and 34% reported seeing and using the nutrition facts to guide their food choices.

With respect to BMI, the results show that all respondents with underweight literally ignored the nutrition facts posted on the counter. 54% of respondents in normal weight group reported seeing and using the nutrition facts. 44% of respondents in overweight group reported seeing the menu labeling and choosing foods under the influence of the nutrition information. Only 33% of respondents in obese group reported noticing and using nutrition facts and guide their food choices as well.

So, people who have a normal weight actually pay more attention to nutrition facts and are more willing to use them compared to other individuals. In general, the

results covered by table 5 demonstrate the uneven influence of menu labeling on food choice in terms of different characteristics of social demographics.

Figure-6, Menu Labels vs. Nutrition Facts



In Figure 6 above, the majority, 54% of participants reported they would like to look for calorie information on label. Since Wilbur Olin Atwater's article published in 1887, the "Calorie" has become popular vocabulary in the U.S. related to diet, health and weight management (Hargrove, 2006). Therefore, it is not surprising that most people consider the calorie the most important fact on that list of label. In addition, 46% of respondents and 40% of respondents show concern about protein and carbohydrate, respectively. In fact, there are many misconceptions associated with carbohydrates and protein over a long time (Duffy, 2012). One popular misconception about carbohydrates is that eating foods with carbohydrates will make you fat. The misconception related to protein is that the more protein you eat, the healthier your food pattern is. Although the US 2010 Dietary Guidelines Advisory Committee's conclusions state "No optimal

macronutrient (protein, fat, carbohydrate) proportion was identified for enhancing weight loss or weight maintenance", food industry is still trying to incorporate high-protein, low-fat and low-carbohydrate into food concept in health and wellness. Thus, the results directly reflect the attitude that people are holding towards carbohydrates and protein under the influence of food industry's marketing promotion strategy. As for the rest of nutrition facts, sugar and fat are regarded each by 38% of respondents, vitamin and sodium are regarded by 33% and 32% of respondents, respectively, only a relative small number of respondents look for fiber (18%), saturated fat (13%) and minerals (10%).

Calorie Intake

Table 7 displays total calorie intake of this sample as well as the individual calorie intake at different food stations. Among 10 food stations, Sizzle (hamburger and french fries) contributed most to total calorie intake (22%) because fast foods offered by the Sizzle station are quite popular as well as high in the calories contents (more than 500 calorie per meal). The foods from the Pizza station and the Mongolian BBQ contributed to 16% and 15% of calorie intake from lunch, respectively. The Home zone station and The Beverage station contribute with 12% each to the calorie intake, which reflect that the consumption of sugar-sweetened beverage, particularly carbonated soft drink has become a considerable source of calorie consumption and therewith contribute a lot to the epidemic of overweight and obesity (Malik et al, 2006). The rest of stations contributed relatively less to the calorie intake, e.g., Deli with 8%, Salad Bar with 7%, Dessert with 4%, Soup and Cereal with 2% each.

Table 7

Calorie Intake at the Dining Hall

Variable	Mean	Sta. De.	Min.	Max.	Contribution (Mean)
Total calories	788	443	35	2577	100%
Mongolian BBQ	88	153	0	663	15%
Deli	64	168	0	1102	8%
Soup	12	38	0	229	2%
Home Zone	116	202	0	832	12%
Sizzles	209	289	0	1225	22%
Pizza	114	175	0	800	16%
Salad Bar	43	104	0	592	7%
Desserts	35	86	0	470	4%
Cereal and Milk	18	62	0	420	2%
Beverage	92	103	0	395	12%

Table 8

Perceived Healthy Value and BMI Categories vs. Calories Intake Categories

	Actual total calorie intake categories			
	Mean Value: 787.80kcal Min: 35.3kcal		Std. Dev. :442.61kcal Max:2576.91kcal	
	Less than 345.19kcal (%)	345.20kcal to 787.80kcal (%)	788.81kcal to 1,230.41kcal (%)	More than 1,230.42kcal (%)
Total Sample	13%	46%	25%	16%
Perceived Healthy Value				
Healthy (6 to 10)	22%	43%	18%	17%
Less than healthy (1-5)	4%	51%	31%	14%
BMI category				
Underweight (<18.5)	25%	25%	25%	25%
Normal weight (18.5 to 24.9)	18%	40%	22%	20%
Overweight (25 to 29.9)	7%	44%	30%	19%
Obesity (>=30)	4%	67%	25%	4%
Menu labeling on food choice				
Yes, for all item chosen	23%	35%	23%	18%
Yes, for some item chosen	11%	57%	14%	17%
No, I didn't notice it.	10%	43%	32%	15%

Table 8 statistically describes how participants' perceive healthy eating, BMI status as well as calorie labeling influence on calorie intake. With regards to perceived healthy value versus calorie intake, 51% of respondents who thought their lunch are less than healthy actually only consumed the calories ranging from 345.20kcal to 787.80kcal. Yet, 18% of respondents who perceived their lunch healthy consumed the calories more than 1,230.42 kcal. Thus, the results to a large extent reflect that quit a number of participants interviewed haven't built a clear healthy eating cognition associating with calorie intake. With respect to BMI status versus calorie intake, compared to respondents with underweight, the majority of normal weight respondents (40%), overweight respondents (44%) and obese respondents (67%) consumed calories ranging from 345.20 kcal to 787.80 kcal, 19% of overweight respondents and only 4% of obese respondents consumed more than 1,230.42 kcal. The results largely reveal that underweight people care little about how many calories they consume and obese people, on the contrary, are more careful not to consume too many calories. Surprisingly, a higher percentage (18%) of respondents who saw and used calorie labeling for all items consumed more than 1,230.42 kcal compared to 17% of respondents who saw and partially used menu labeling and 15% of respondents who reported not seeing menu labeling at all.

Calorie Estimation

Table 9 indicates whether the patrons underestimate or overestimate every single meal by comparing the mean of estimated calories with the mean of objective calories. Among seven meals, some had complete calorie information posted on the menu board, including Pepperoni Pizza, Pesto Orzo Salad and Chipotle Chicken Sandwich. Mongolian

BBQ was posted the calorie contents for sauce, rice and beef steak. Salad was only posted the calorie information for dressing sauce. Chocolate Cake and Grape Juice were not posted any calorie information.

Table 9

Comparison between Actual Calories and Estimated Calories for 7 Meals

Meal Items	Calorie Labeling posted	Mean Calorie Estimates	Objective Calorie Levels	Mean Difference Between Estimates and objective levels	% of Mis-estimation
1 plate Mongolian grill (white rice, Philly beef steak, broccolis, pepper, onion and Korean BBQ sauce)	Some Ingredients posted	570	374	196	52
1 slice Pepperoni Pizza	Posted	375	157	218	138
1 serving Pesto Orzo Salad	Posted	279	217	62	29
1 Chipotle Chicken Sandwich	Posted	428	550	-122	-22
1 plate of Salad (Lettuce, grape tomatoes, olives, chopped eggs, raisins and honey mustard sauce)	Some ingredients posted	252	299	-46	-16
1 piece of Chocolate Cake	Not posted	440	235	205	87
1 cup of Grape Juice	Not posted	157	195	-38	-19

The results in table 9 show that, on average, the respondents overestimate or underestimate all the meals in question whether the calorie information was provided or not. The misestimation for meals with menu labeling reflects that the participants interviewed did not memorize the calorie information posted afterwards even though they might have noticed and used the calorie information when they ordered their foods. Pepperoni Pizza ranks first place which was overestimated at 138% compared to the objective calorie count. Chocolate Cake followed as second with an overestimation of

87%. Mongolian BBQ was also overestimated by 52%. Another reason for misestimation of Pepperoni Pizza and Mongolian BBQ may be that the respondents did not take the serving size into account even though calorie information was available. As for Chocolate cake, overestimation most likely occurred because people tend to perceive chocolate cake as high calorie and high sugar foods but ignore the serving size.

In addition, Pesto Orzo Salad was overestimated by 29%. Chipotle Chicken Sandwich, Salad and Grape Juice were underestimated by 22%, 16% and 19%, respectively. The results show that Salad and Grape Juice were on average estimated mostly close to the objective calories even though the calorie information was not available for the participants interviewed. In comparison with the results of Burton et al. (2006), the extent of over- or under- estimation for high-calorie foods in this study (Pesto Orzo Salad was overestimated by 29% and Chipotle Chicken Sandwich was underestimated by 22%), is far lower than the extent of underestimation for similar foods in Burton et al. (2006) (Hamburger and fries was underestimated by 90% and Chef's Salad was underestimated by 84%), where no calorie information was available.

Interactions during the Lunch

Graphs can visually demonstrate the interaction between the members in a group using in-degree and out-degree. Figure 7 shows how four nodes in sample Group 6 interacted with each other in terms of the questions "whether or not you noticed the foods ordered by the other three members before ordered yours" (Notice 1) and "whether or not you notice the foods ordered by other three members when you were eating

together”(Notice 2). For an individual node, the arrow-out (out-degree) represents noticing the foods ordered by other members, the arrow-in (in-degree) means other members noticed the food ordered by this individual node. Furthermore, table 10 summarizes the number of in-degree and out-degree for each node in two scenarios, Notice 1 and Notice 2. Combined with Figure 7 and Table 110, the results show node G61 is a *prominent* and *influential* person in Group 6 because he/she has the highest in-degree (3 for Notice 1 and 2 for Notice 2) and out-degree (3 for Notice 1 and 3 for Notice 2) in both scenarios.

Figure-7, In-degree and Out-degree of Notice 1 (left) and Notice 2(right) for Group 6

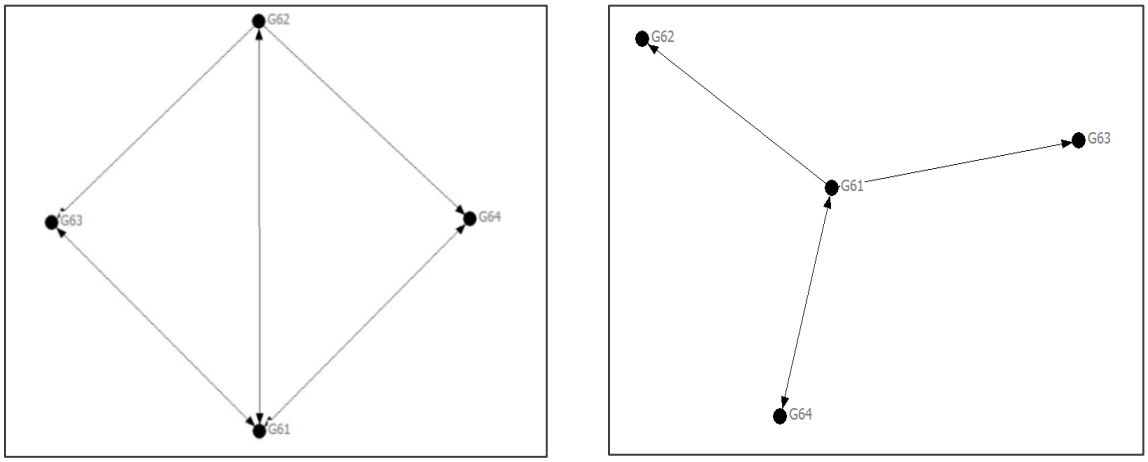


Table 10

In-degree and Out-degree in Notice 1 and Notice 2

Scenario	No. of Degree	Nodes			
		G61	G62	G63	G64
Notice 1	In-degree	3	1	2	2
	Out-degree	3	3	1	1
Notice 2	In-degree	2	1	1	1
	Out-degree	3	0	1	1

Table 11

Peers' Interactions during the Lunch in terms of In-degree and Out-degree

	Mean		Std. Dev.		Min		Max	
	ID	OD	ID	OD	ID	OD	ID	OD
Noticed what food (s)he ordered before I ordered (*Notice 1*)	0.74	0.74	0.73	1.01	0	3	0	3
Noticed what food (s)he ordered while eating together(*Notice 2*)	1.83	1.83	0.80	1.27	0	3	0	3
Talked about the food with him or her before I ordered (*Talk 1*)	0.71	0.71	0.72	0.96	0	3	0	3
Talked about the food with him or her while eating together (*Talk 2*)	1.35	1.35	0.97	1.27	0	3	0	3
Ordered the same foods as his or hers at initial order (*Order 1*)	0.88	0.88	0.89	1.04	0	3	0	3
Ordered the same foods as his or hers later (*Order 2*)	0.38	0.38	0.65	0.73	0	3	0	3
Recommended my food to him or her before eating (*Recommended 1*)	0.54	0.54	0.67	0.88	0	3	0	3
Recommended my food to him or her while eating (*Recommended 2*)	0.76	0.79	0.74	1.08	0	3	0	3

Table 11 provides a statistical overview on lunch interactions in terms of in-degree and out-degree for all the respondents (Degree centrality may vary within the individual group). Eight interactions are briefly presented as "Notice 1", "Notice 2", "Talk 1", "Talk 2", "Order 1", "Order 2", "Recommend 1" and "Recommend 2". Of these interactions, "Notice 2" is the most popular one with the mean value of 1.83 for both in-degree and out-degree, "Talk 2" ranks second place with the mean value of 1.35 for both in-degree and out-degree. "Order 1" (0.88 for both in-degree and out-degree), "Recommend 2" (0.76 for in-degree and 0.79 for out-degree), "Notice 1" (0.74 for both in-degree and out-degree), and "Talk 1" (0.71 for both in-degree and out-degree) also presented relative high mean value in-degree and out-degree compared to the rest of the interactions. The results are highly consistent with the actual situations that an individual

has more chances to notice the foods ordered by the peers (Notice 2), talk to the peers about the foods (Talk 2), and recommend the foods to the peers (Recommend 2) while they are dining together than when they initially order food. But the individual wouldn't like to go back the food court to get the same foods as peers (Order 2). On the other hand, the individual prefers to order the same foods as peers at initial order (Order 1).

Model Results and Discussion

In this thesis, the amount of calorie intake was determined by the units of each food item consumed and the corresponding amount of calories per unit. Of these two important variables, the units of each food item were determined under based on several factors. First, the units of foods consumed relied entirely on the participants' self-reported data, which were collected via the check list in the questionnaire. Therefore, the participants might accidentally or intentionally under-report or over-report units of food items, which ultimately would result in under-reporting or over-reporting of total calorie intake. Second, given the survey setting is an all-you-can-eat buffet style dining hall, the participants may go back to pick up more foods after the survey. Thus, the reported calorie intake may not necessarily represent the total calorie consumption for the lunch surveyed. Third, the leftover of foods was not accounted for in this study, which may cause over-reporting the amount of calorie intake.

Due to over-reporting or under-reporting of total calorie intake, this study chooses the calorie intake from individual food stations to econometrically determine what increases or decreases calorie consumption. Among ten food stations, the Pizza station,

on average, contributed to 16% of total calorie intake just behind the Sizzle station (22%) (See table 7 for details). In addition, the Pizza station only provides pizza and pasta instead of diverse foods (e.g., the Home Zone station offers meat, vegetable; the Deli station offers mini paninis, sandwiches and prepared fruit or vegetable salads; the Sizzle station offers sandwiches, burgers, hog dogs and french fries). Thus, the calorie intake from pizza and pasta can be linked better to social influence and nutrition facts than calorie intake from other food stations. Since there was a share of participants who did not consume calories from pizza and pasta (minimum of zero), a Tobit model with the lower boundary set to 0 kcal and the upper boundary set to 801 kcal that is one greater than the maximum value, to account for the truncated data.

Table 12 shows the results of the Tobit model that measures the effects of obesity status, nutrition labeling and social interactions on the calorie consumption from pizza and pasta. Two pairs of dummy variables, Ego Obese and Peer Obese as well as Ego Label and Peer Label, are used to determine the indirect social influence on the calorie intake. The in-degree and out-degree of four social interaction scenarios, "Notice 1", "Order 1", "Notice 2", and "Talk 1" are used to measure directed social influence on calorie intake. Age and gender are also included in this model to determine the effects of demographic characteristics on calorie intake. The coefficients of Age, Peer obese, Ego noticed nutrition facts, Order 1 in-degree and Notice 2 in- degree are statistically significant with p value less than 0.01. The coefficients of Notice 1 out-degree and Talk 2 out-degree are significant with p value less than 0.1.

Table 12

Influence of Peers' Obesity Status, Nutrition Labeling, Social Interactions on Calorie Intake from Pizza & Pasta

	Coeff.	**Std. Err.**	**t-value**
Age	-16.670***	5.474	-2.95
Gender	-62.170	88.983	-0.70
Ego Obese	89.491	96.881	0.92
Peer Obese	228.011***	81.241	2.81
Ego Label	-262.178***	85.719	-3.06
Peer Label	-11.355	88.158	-0.13
Notice1 Out-degree	80.477*	37.744	2.13
Notice 1 In-degree	22.155	55.320	0.40
Order1 Out-degree	-31.218	42.020	-0.74
Order 1 In-degree	-177.168***	56.466	-3.14
Notice 2 Out-degree	43.975	30.119	1.46
Notice 2 In-degree	-127.289***	45.927	-2.77
Talk 2 Out-degree	-59.959*	31.071	-1.93
Talk 2 In-degree	51.200	44.160	1.16
Constant	582.360	166.888	3.49
Sigma	291.997		
Prob > chi 2	0.0001		
LR chi 2(14)	43.84		
Pseudo	0.0628		

Note: *** means $p < 0.01$, * means $p < 0.1$

Regarding the calorie intake through pizza and pasta, the results show that if the individual is dining in a group where at least one group member is obese, the calorie intake increases 228 calories. If the individual notices the calorie labeling, then the calorie intake drops 262 calories. When the age of individual grows from younger range to older range (e. g., from between 18 and 24 years old to between 25 and 34 years old), the calorie intake drops 16.67 calories. As for lunch interactions, the direction of information flow may vary depending on different interactions. When the out-degree of Notice 1, the information inflow, increases one more unit, the calorie intake increases 80 calories. When the in-degree of Order 1, the information outflow, increases one more unit, the calorie intake drops 177 calories. When the in-degree of Notice 2, the information outflow, increases one more unit, the calorie intake drops 127 calories. When the out-degree of Talk 2, the information outflow, increases one more unit, the calorie intake drops 60 calories. Both "Ego Obese" and "Peer Label" have no significant influence on the calorie consumption.

The results shown in table 12 indicate that (1) age sigificantly influences the calorie consumption compared to gender because the average amount of calorie intake generally decreases with age instead of by gender (2) the hypothesis that obese individuals in a group consume more calories than the group without obesity is confirmed in that peers' obesity status, as a strong social influence, sponteneously reduce the sensativity of an individual to the obesity and therewith increase the probability of

Table 13

Influence of Peers' Obesity Status, Nutrition Labeling, Peers' Interactions and Strength of Ties on the Calorie Intake from Pizza & Pasta

		Coeff.	**Std. Err.**	**t-value**
Age		-14.109*	5.890	-2.40
Gender		-122.158	95.086	-1.28
Ego Obese		48.064	101.544	0.47
Peer Obese		212.814*	87.032	2.45
Ego Label		-291.277***	89.187	-3.27
Peer Label		-42.281	90.680	-0.47
Notice1 Out-degree		88.648*	38.763	2.29
Notice 1 In-degree		13.190	6.626	0.23
Order1 Out-degree		-15.405	43.382	-0.36
Order 1 In-degree		-163.140***	55.788	-2.92
Notice 2 Out-degree		37.152	30.943	1.2
Notice 2 In-degree		-120.092*	46.909	-2.56
Talk 2 Out-degree		-67.898*	32.394	-2.10
Talk 2 In-degree		55.791	44.805	1.25
Eating with peers who met at the first time		-22.854	107.577	-0.21
Eating with peers who are acquaintances		58.563	95.748	0.61
Eating with at-least friends		-80.205	138.471	-0.58
Constant		634.705	237.364	2.67
Sigma	288.127			
Prob > chi 2	0.0002			
LR chi 2(17)	46.12			
Pseudo	0.0676			

Note: *** means $p < 0.01$, * means $p < 0.1$

consuming more calories. (3) the hypothsis that nutrition facts reduce an individual's calorie intake is confirmed because nutrition facts, as an information intervention scheme, to a certain extent influence the individual's weight-related behavior which in most time appears as less calorie intake, but the influence of nurtrition facts on calorie intake is not transmissiable through the social network because the observed peers' food choices are affected by a variety of factors (e.g., taste, cost, convenience, etc.) so that it is difficulat for the members of the social network to differentiate the effect of calorie information from the effects of the other factors when they are dining together. (4) the hypothsis that social interactions influence the amount of calorie intake is confirmed in that the interactions with peers directly impact an individual's behavior and the extent of impact also vary depending on the way and the time of the interactions.

Table 13 shows the results of a extended logit model incorporated the closeness which significantly indicates the strength of ties in a network (Marsden & Campbell, 1984). Compared with the results shown in Table 12, only two coefficients for "Ego Label" and "in-degree of Order 1"are significant with p value less than 0.01. The coefficients of "Age", "Peer Obese", out-degree of Notice 1", "in-degree of Notice 2" and "out-degree of Talk 2" are relatively significant with p value less than 0.1. The coefficients of three closeness variables are not significant at all.

The results displayed in table 13 reflect that the hypothesis that the strength of ties indicated by the closeness influence the amount of calorie intake is not confirmed and adding the closeness to the tobit model even weakens the effects of peers' obesity status and the interactions during the lunch on the calorie intake. Though the closeness is the

strongest indicator measuring tie-strength of a social network, it doesn't necessarily influence all diet-related behaviors. The reasons behind the results may be that (1) an individual involved in a group dining together at the dining hall would like to pay attention to the calorie consumption on the basis of peers' weight-related appearances and the communications with them instead of how intense their relationships are. (2) The trend of the closeness in this sample is accidently similar to the trends of the other variables so that the contribution of the closeness to the extended tobit model is offset by the other variables.

CONCLUSION

The rate of overweight and obesity in the U.S. is still on the rise, which poses a threat to overall health of the society. The excess calorie intake from away from home foods (e.g., restaurant, cafeteria, and etc.) is widely blamed to contribute to the epidemic of overweight and obesity. Menu labeling, which focuses on the foods from restaurant, has been increasingly promoted as a policy solution to address the obesity issue. Whether and to what extent menu labeling influences the calorie consumption are of interest to policy makers. On the other hand, peers' obesity and peers' social interactions also significantly influence the individual's weight-related behaviors. College students are a specific group which has more opportunities to be exposed to the influence of social networks. This thesis mainly analyzes the influence of peer effects on calorie intake in a university dining hall with posted nutrition facts by conducting a group survey. The findings of the study are concluded in the following paragraphs.

First of all, this study analyzes the strength of ties and the strength of lunch ties of patrons who are dining at university dining hall using group matrix data and weighted method. A few basic shapes of social network, circle, chain, incomplete and all-channel, can be visually illustrate by the social network graphs of four sample groups. The results also show that the strength of lunch ties, to a large extent, derives from the strength of ties indicated by contact frequency and closeness. In a group of four, the individual member who has a relatively weak tie with other members may either have a weak lunch tie or lose lunch tie with other members.

Secondly, this study summarizes self-reported impact of menu labeling on food choice as well as the variation of this impact among different demographic characteristics. The results reveal that even though taste is still the most important factor for dining hall patrons to make any food choices, nearly half (46%) of the people interviewed reported seeing and using calorie information. Among these people, proportionally, females, Asian/Pacific Islander, seniors, and normal weight people are more likely to notice and use menu label than males, other ethnic groups, youngsters, and obese people, respectively.

Thirdly, the variation of calorie intake among perceived healthy value, obesity status and food choice influenced by menu labeling is examined in this study using the method of cross tabulate. The results show that participants interviewed have not yet linked healthy eating comprehension with calorie intake, obese people are more likely to consume appropriate amount of calories compared to other BMI groups, but people who reported noticing and using menu labeling still consumed large amounts of calories. Furthermore, this study evaluates the level of calorie misestimating for seven meals in which some are posted calorie sign and some are not. The results reflect that dining hall patrons mis-estimated calorie information for all meals in question even though they claimed noticing and using menu labeling. On the other hand, the misestimating for high-calorie foods could be mitigated by providing nutrition facts.

Fourthly, this study uses two Tobit models to measure the effects of social networks and nutrition sign posting on calorie intake. Results of the first model are highlighting the effects of social networks on calorie consumption from pizza and pasta.

On the one hand, dining in a group with at least one obese member significantly increases calorie intake, which proves the first hypothesis that obese individuals dining together consume more calories than those who are not obese. On the other hand, food-related interactions with outflow of information significantly decrease calorie consumption from pizza and pasta, which partially testifies the third hypothesis that social interactions in a network influence the amount of calorie intake. With respect to the effects of menu labeling hypothesized, the results of the first model testify that noticing and using menu labeling does decrease the calorie intake, but peer effects do not significantly amplify the effects. Furthermore, the results of the second Tobit model indicate that closeness is not only lack of influence on calorie intake but undermines the effects of peer obesity status and lunch interactions on calorie consumption.

Overall, this study provides a unique contribution to the literature by assessing calorie intake with regards to social networks and menu labeling. While data was collected in a university setting, the methods are readily transferrable to other dining settings, such as schools, hospitals and even workplaces. Results from this study will improve the understanding of food choice in context with social networks, which will allow a more targeted approach to health promotion in various dining settings.

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APPENDIX-A

SURVEY INSTRUMENT

Questionnaire Group No. ______ Member No. ______

This is the first part of the survey. We would like to start with a few questions related to the group you are dining with. This is an anonymous survey and your name is not linked to the responses. In addition, all of this information will be treated as confidential. Results of the survey will only be used in aggregate form and only for research purposes.

For the following questions, check or fill in the answers which best describe you.

1. Please indicate how often on average you are in touch with each member of this group in the following ways. (You may have more than one way to contact each of them.)

Member #	Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily
Social network website (Facebook, Twitter, etc.)						
E-mail/texting						
Phone call/Online calling e.g. Skype						
Meet face-to-face						

Member #	Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily
Social network website (Facebook, Twitter, etc.)						
E-mail/texting						
Phone call/Online calling e.g. Skype						
Meet face-to-face						

Member #	Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily
Social network website (Facebook, Twitter, etc.)						
E-mail/texting						
Phone call/Online calling e.g. Skype						
Meet face-to-face						

2. Which category describes best the relationship between you and each member of this group? (Please circle a number of each member.)

	Member #	Member #	Member #
Meeting for the first time today	1	1	1
Acquaintance	2	2	2
A friend or kinship	3	3	3
A good friend or kinship	4	4	4
A close friend or kinship	5	5	5

3. On average, how often do you have lunch with each member of this group? (Please circle a number for each member.)

	Member #	Member #	Member #
Less than monthly	0	0	0
Monthly	1	1	1
A few times a month	2	2	2
Weekly	3	3	3
A few times a week	4	4	4
Daily	5	5	5

4. The following statements are related to food ordered by both you and other members of the group. Please indicate for each member whether they are true.

Statement	Member #	Member #	Member #
I noticed what food (s)he ordered before I ordered mine.	True _____	True _____	True _____
I talked about the food with him/her before I ordered mine.	True _____	True _____	True _____
I ordered the same food as his/hers.	True _____	True _____	True _____
I recommended my food to him/her when we were doing our first order.	True _____	True _____	True _____
I noticed what food (s)he ordered while we were eating together.	True _____	True _____	True _____
I talked about the food to him/her while we were eating together.	True _____	True _____	True _____
I went back to the food court one more time to get his/her food.	True _____	True _____	True _____
I recommended my food to him/her while we were eating together.	True _____	True _____	True _____

5. On average, how often do you have lunch at the Citrus Dining Hall?

Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily

6. Please tick the 3 most important factors that influence your food choice when eating at the Citrus Dining Hall.

Appearance		Hunger level	
Convenience		Food safety	
Calories		Friends' food choice	
Cravings		Taste	

7. Please indicate how much you like the food from each of the following food stands (1 = do not like it and 5 = like it very much).

Food Stand	**Do not like it**				**Like it So much**
Mongolian BBQ	1	2	3	4	5
Deli	1	2	3	4	5
Soup	1	2	3	4	5
Home Zone	1	2	3	4	5
Sizzle (Burger, Fries, etc.)	1	2	3	4	5
Pizza	1	2	3	4	5
Salad and fruit	1	2	3	4	5
Dessert	1	2	3	4	5
Cereal and bread	1	2	3	4	5
Beverage (including milk and soft drink)	1	2	3	4	5

8. When you ordered the food today, did the nutrition facts influence your choice?

Yes, for all items I chose. _____
Yes, for some items I chose. _____
No, I didn't pay attention to nutrition facts. _____

9. Please indicate which of the following nutrition facts you usually look for when referring to nutrition labels. Choose all that apply.

Amount of carbohydrate		Amount of sodium	
Amount of fiber		Amount of sugar	
Amount of fat (in total)		Calories	
Amount of protein		Minerals	
Amount of saturated fat		Vitamins	

10. Please mark all the foods that you have ordered today:

MONGOLIAN BBQ			
Dressing Sauce	**Unit**	**Vegetable**	**Unit**
Curry Pad Thai Sauce	serving	Celery	serving
Teriyaki Sauce	serving	Sliced Carrots	serving
Korean BBQ Sauce	serving	Mushrooms	serving
Black Bean Sesame Sauce	serving	Italian Squash	serving
General Tso Sauce	serving	Zucchini	serving
Sweet & Sour Sauce	serving	Baby Corn	serving
Orange Peanut Sauce	serving	Bok Choy	serving
Orange Ginger Sauce	serving	Cabbage	serving
Sweet & spicy chili Sauce	serving	Water Chestnuts	serving
Main Dish	**Unit**	Yellow Onions	serving
White Rice	serving	Broccoli	serving
Chow Mein Noodle	serving	Bell Pepper	serving
Rice Noodle	serving	Tofu	serving
Spaghetti	serving	Egg Roll	each
Fortune cookie	piece	**Meat**	**Unit**
Rice sticks	A little / A lot	Philly Chicken Steak	serving
Crispy Wonton Straws	A little / A lot	Philly Beef Steak	
SOUP (You can mark ½ or ¼ spoon as well.)			
Soup	**Unit**	**Soup**	**Unit Spoon**
Chicken Noodle Soup	spoon	Vege & Bacon Tomato Soup	spoon
Cheddar Cauliflower Soup	spoon	Saltine Crackers	piece
DELI			
Meat and Cheese	**Unit**	**Bread and Wrap**	**Unit**
Ham	serving	Sara Lee Deli Rolls	each
Salami	serving	Sara Lee Whole Wheat	slice
Turkey Breast	serving	Raibo White Bread	slice
Cheddar cheese	slice	Tortilla Wrap	each
Pepper Jack cheese	slice	**Vegetable and Dressing**	**Unit**
American cheese	slice	Pickles	serving
Chips, Salad and others	**Unit**	Lettuces	serving
Cajun Potato Chips	A little / A lot	Purple Onions	serving
Italian Panini	each	Sliced Tomatoes	serving
Carrot Raisin Salad	serving	Mustard	serving
Red Potato Salad	serving	Honey Mustard	serving
Fruit Salad	serving	Mayonnaise	serving
		Chipotle Mustard	serving
PIZZA			
Pizza	**Unit**	**Others**	**Unit**
Classic Cheese Pizza	piece	Garlic Herb Breadstick	each
Pepperoni Pizza	piece	Smoky Chipotle Mac Cheese	serving
Hawaiian Pizza	piece	Creamy Ranch Pasta Salad	serving
HOME ZONE			
Meals	**Unit**	**Meals**	**Unit**
Spicy Fish Tacos	each	Italian Roasted Vegetable	serving
Garlic Toast	slice	Eggplant Parmesan	piece
Rotini Marinara	serving		

GRILL	Unit	Side Dish	Unit Each
Grilled Cheese Sandwich	each	Crispy Shoestring French Fries	A little / A lot
Turkey burger	each	Baked Sweet Potatoes	each
Crispy Chicken Sandwich	each	Baked Russet Potatoes	each
Garden Burger	each	Hot Dog	each
Grilled Herb Chicken Sandwich	each		
Hamburger	each		
Bistro Chicken Sandwich	each		
SALAD			
Vegetables	**Unit**	**Salad Dressing**	**Unit**
Mushrooms	A little / A lot	Honey Mustard	spoon
Corns	A little / A lot	Sesame	spoon
Olives	A little / A lot	Ranch	spoon
Broccolis	A little / A lot	Reduced Fat Ranch	spoon
Shredded Carrots	A little / A lot	Italian	spoon
Sliced Cucumbers	A little / A lot	French	spoon
Chopped Onions	A little / A lot	Caesar	spoon
Grape tomatoes	A little / A lot	Blue Cheese	spoon
Lettuce	A little / A lot	Balsamic Vinaigrette	spoon
Cauliflowers	A little / A lot	Fat-free Raspberry Vinaigrette	spoon
Spinach and Lettuce	A little / A lot	Raisins	A little / A lot
Sliced Tomatoes	A little / A lot	Goldfish crackers	A little / A lot
Shredded Cheddar Cheese	A little / A lot	Rice sticks	A little / A lot
Chopped Ham	spoon	Croutons	A little / A lot
Chopped eggs	spoon	Pita Chips	A little / A lot
Kidney Beans	spoon	Orange	each
Pickled pepper	A little / A lot	Apple	each
Red Potato Salad	spoon	Banana	each
Garbanzo Bean Salad	spoon	Cantaloupe or Honeydew	piece
Peach, Canned	piece	Water Melon	piece
DESSERT			
Type	**Unit**	**Type**	**Unit**
Sachima	piece	cake	piece
Ice Cream Cone	each	Pudding	each
BEVERAGE			
Drink	**Unit**	**Juice and Other**	**Unit cup**
Dr Pepper	cup	Grape Juice Beverage	cup
Dr Pepper Diet	cup	Apple Juice	cup
Coca-Cola Zero	cup	Cranberry Juice Cocktail	cup
Minute Maid Lemonade	cup	Premium Orange Blend	cup
POWERADE	cup	Iced Tea unsweetened	cup
Sprite	cup	Cappuccino-Hot Chocolate	cup
Coke Diet	cup	Cappuccino-French Vanilla	cup
Coca-Cola	cup	Cappuccino-Triple Shot Mocha	cup
Coffee	mug	Crystal Light-Raspberry ice	cup
Coffee Creamy	packet	Crystal light-lemonade	cup
Sugar	packet		
Please indicate any foods which are not included on the check list but you already had today.			
Food Name	**Unite**	**Food Name**	**Unit**

11. Since you just have indicated what you had for lunch today, what do you think, how healthy was your lunch on a scale from 1 (very unhealthy) to 10 (very healthy)?

Very unhealthy (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	Very healthy (10)

12. What do you think, how many calories had your lunch today? Please include everything, also beverages. Just make your best guess…

_______Calories

13. What is your best guess as to how many calories each of the following meals are having at the Citrus Dining Pavilion?

Meals	Serving Size	Estimated Calories
Mongolian Grill White rice, philly beef steak, broccolis, pepper, onion and Korean BBQ sauce	1 plate	
Pepperoni Pizza	1 slice	
Pesto Orzo Salad	1 serving	
Chipotle Chicken Sandwich	1 each	
Salads with lettuce, grape tomatoes, olives, chopped eggs, raisins and honey mustard sauce	1 plate	
Chocolate cake	1 piece	
Minute Maid Grape Juice	1 cup	

This is the final part of the survey. I would like to ask you a few questions about yourself as this is very important to analyze the data. As mentioned in the beginning, this is an anonymous survey and your name is not linked to the responses. All of this information will be treated as confidential and the results of the survey will only be used in aggregate form.

14. How old are you? _____years

15. Please indicate your gender. Male ( ) Female ( )

16. Are you: Student ( ) Faculty ( ) Staff ( ) Visitor ( )

17. On average, how often do you eat away from home?

Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily

18. On average, how often do you eat lunch away from home with your friends?

Less than monthly	Monthly	A few times a month	Weekly	A few times a week	Daily

19. What is your educational background? Mark the box next to the highest level of education you have completed.

High School Dipolma _____ Bachelor's Degree _____ Some college _____
Technical School Diploma _____ Associate's Degree _____ Bachelor's Degree _____
Master's Degree _____ Doctorate _____ Other: _____

20. Please indicate your approximate annual household income before taxes:

Less than $10,000 _____ $10,000 to $29,999 _____ $30,000 to $49,999 _____
$50,000 to $69,999 _____ $70,000 to $99,999 _____ More than $100,000 _____

21. Please indicate which ethnic group you belong to?

White _____ Hispanic _____ Native American _____
African American _____ Asian/Pacific Islander _____ Other _____

22. How much did your today's lunch cost? _____Dollars

23. Do you have a meal plan?

Yes ____, Please indicate which type: _____No _____

24. Please indicate your weight and height – make your best guess.

Weight indicate lb or kg_____
Height indicate cm or inches _____

Thank you very much for your time!

APPENDIX-B

MENU AND CALORIE TABLE

Menu and Calorie Table (01/30/2014 to 02/07/2014)

Mongolian BBQ			
Please specify how many Plates you had today:			
Dressing Sauce	**Serving Size (2oz)**	**Vegetable**	
Curry Pad Thai Sauce	40 kcal/1 fl oz	Celery	4 kcal/28g
Teriyaki Sauce	37 kcal/1 fl oz	Sliced Carrots	11 kcal/28g
Korean BBQ Sauce	43 kcal/1 fl oz	Mushrooms	10.8 kcal/28g
Black Bean Sesame Sauce	37 kcal/1 fl oz	Italian Squash	4.7 kcal/28g
General Tso Sauce	43 kcal/ 1 fl oz	Zucchini	4.7 kcal/28g
Sweet & Sour Sauce	20 kcal/1 fl oz	Baby Corn	15 kcal/1oz
Orange Peanut Sauce	94 kcal/1 fl oz	Bok Choy	3.6 kcal/28g
Orange Ginger Sauce	41 kcal/1 fl oz	Cabbage	7.3 kcal/28g
Sweet & spicy chili Sauce	98 kcal/1 fl oz	Water Chestnuts	27 kcal/28g
Main Dish	**Serving Size (1/2 cup)**	Yellow Onions	11 kcal/28g
White Rice	111.87 kcal/1/2 cup	Broccoli	9 kcal/28g
Chow Mein Noodle	87.75 kcal/1/2 ozw	Red Pepper	11 kcal/28g
Rice Noodle	61.73 kcal/1/2cup	Tofu	41.10 kcal/1 oz
Spaghetti	115 kcal/1/2 cup	Egg Roll	83.3 kcal/each
Fortune cookie	30 kcal/1 each (8g)	**Meat**	Serving Size (3 oz)
Rice sticks	95 kcal/1 oz	Philly Chicken Steak	121.95 kcal/3 oz
Crispy Wonton Straws	95.37 kcal/ 1 oz	Philly Beef Steak	188.48 kcal/3 oz
SOUP			
Soup	**Unit**	**Side appetizer**	**Unit**
Chicken Noodle Soup	101.92 kcal/8 fl oz	Saltine Crackers	4 kcal/1 bite size
Turkey Kale Soup	108.13 kcal/8 fl oz	**Soup**	**Unit**
Cream of Broccoli Soup	184.1 kcal/8 fl oz	Sweet Tomato Soup	91.38 kcal/8 fl oz
Sauerkraut Kielbasa Soup	125.64 kcal/8 fl oz	Lentil Vegetable Soup	99.51 kcal/8 fl oz
Beef Mushroom Barley Soup	111.66 kcal/8 fl oz	Curried Tomato Lentil Soup	99.93 kcal/8 fl oz
Swiss Mock Crab Soup	282.49 kcal/8 fl oz	Three Bean Chili	142.21 kcla/8 fl oz
Roasted Corn Chowder	193.08 kcal/8 fl oz	Vegetable Soup w/ Brown Rice	75.19 kcal/8 fl oz
Chicken Rice Soup Florentine	98.13 kcal/8 fl oz	Cheddar Cauliflower Soup	244.74 kcal/8 fl oz
Vege & bacon tomato soup	165.95 kcal/8 fl oz	Calm Chowder	126.74 kcal/8 fl oz
DELI			
Meat and Cheese	**Unit**	**Bread and Wrap**	**Unit**
Ham	70.87 kcal/2 ozw	Sara Lee Deli Rolls	180 kcal/1 each
Salami	240.97 kcal/2 ozw	Sara Lee Whole Wheat	120 kal/2 slices
Turkey Breast	58.97 kcal/2 ozw	Raibo White Bread	160 kcal/2 slices
		Udis Gluten Free Bread	140 kcal/2 slices
Cheddar cheese	113 kcal/1 slice	Tortilla Wrap	94 kcal/1 medium
Pepper Jack cheese	80 kcal/1 slice	**Vegetables**	**Unit**
American cheese	94 kcal/1 slice	Pickles	5 kcal/1 oz
Salad and others	**Unit**	Lettuces	3.8 kcal/28g
Chunky Chicken Salad	159.28 kcal/2 ozw	Purple Onions	11 kcal/28g
B.L.T Sandwich	317.87 kcal/1 each	Sliced Tomatoes	5kcal/28g
Italian Panini	293.24 kcal/1 each	**Dressings**	**Unit**
Carrot Raisin Salad	237.22 kcal/1/2cup	Mustard	35 kcal/1/2 oz
Red Potato Salad	280.9 kcal/1/2 cup	Honey Mustard	70 kcal/1/2 oz
Fruit Salad	36 kcal/1/2 cup	Mayonnaise	94 kcal/1/2 oz
Creamy Tuna Salad	145.86 kcal/4 ozw	Chipotle Mustard	35 kcal/1/2 oz
Mini Lemon-Pepper Chicken Sandwich	169.74 kcal/1 each	**Chips**	**Unit**
Mini Chicken Salad Sandwich	158.6 kcal/1 each	Ranch Potato Chips	309.26 kcal/2 ozw
Three Cheese Sub	372.36 kcal/ 1 each	Cajun Potato Chips	303.61 kcal/2 ozw
Southwest Cheddar Jack Panini	321.66 kcal/ 1 each	Mesquite Potato Chips	311.97 kcal/2 ozw
Mini Italian Sandwich	150.26 kcal/ 1 each	Peanut Butter Banana Panini	352.14 kcal/1 each
Pesto Orzo Salad	216.62 kcal/ ½ cup	Ham & Swiss Panini	254.73 kcal/1 each

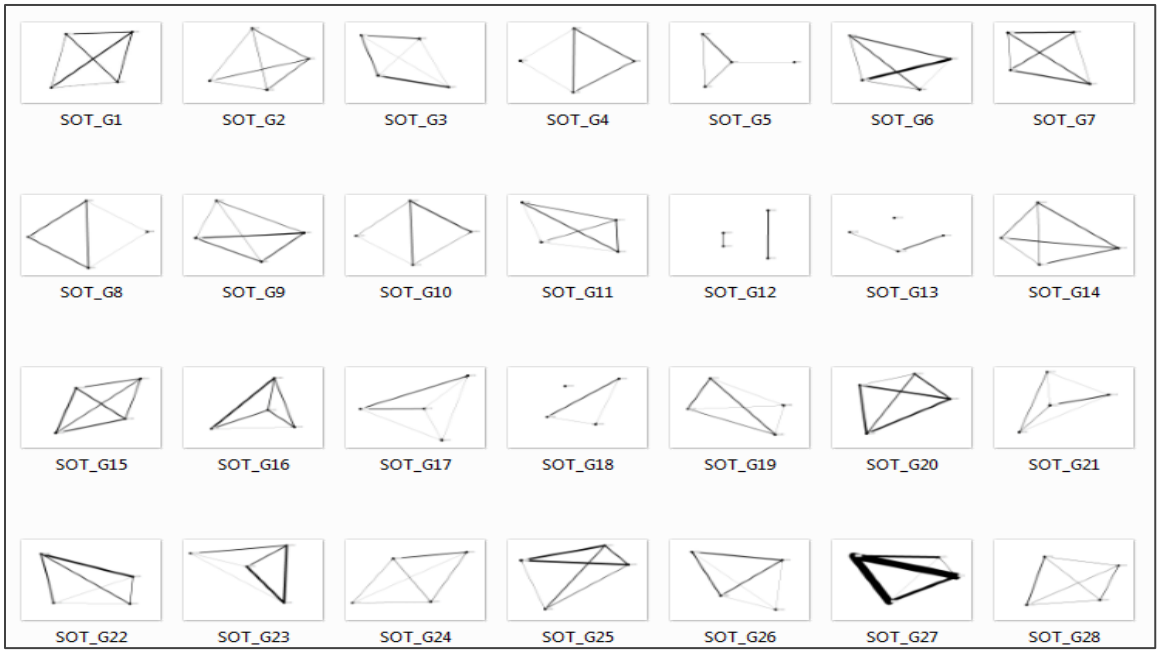
PIZZA			
Pizza	**Unit (1/12 cut)**	**Others**	**Unit (Each)**
Classic Cheese Pizza	176.3 kcal/slice	Garlic Herb Breadstick	125.02 kcal/1 each
Pepperoni Pizza	157.18 kcal/slice	Smoky Chipotle Mac&Cheese	235.06 kcal/1/2 cup
Hawaiian Pizza	182.02 kcal/slice	Creamy Ranch Pasta Salad	114.98 kcal/1 each
Meat Lover's Pizza	219.64 kcal/slice	Farfalle & Sausage Alfredo Bake	466.99 kcal/8 fl oz
Rotini & Grilled Vegetable Salad	125.77 kcal/1/2 cup	Penne Pasta Salad	141.66 kcal/1/2 cup
BBQ Mini Calzone	434.81 kcal/1 each	Caesar Salad	240.5 kcal/1 each
Buffalo Chicken Pizza	170.95 kcal/slice	Garden Salad	47.34 kcal/1 serving
Grilled Eggplant Pizza	172.55 kcal/slice	Four Cheese Penne	287.43 kcal/8 fl oz
Pepperoni Calzone	289.44 kcal/1 each	Marinara Sauce	24.87 kcal/1 fl oz
Homestyle Baked Ziti	287.66 kcal/8 fl oz	Spicy BBQ Sauce	61.66 kcal/1 fl oz
Margherita Pizza	153.3 kcal/slice	Rotini & Grilled Vege Salad	125.77 kcal/1/2 cup
Pepperoni Melt	288.29 kcal/1 each	Buffalo Chicken Stromboli	250.13 kcal/1/8 cut
BBQ Chicken pizza	194.86 kcal/slice	Baked Mac & Cheese	227.03 kcal/1/2 cup
HOME ZONE			
Meals	**Unit**	**Meals**	**Unit**
Shrimp & Grits	292.33 kcal/1 serving	Seasoned Corn	99.42 kcal/1/2 cup
Salisbury Steak w/ Mushroom Sauce	301.58 kcal/1 serving	Homestyle Mashed Potatoes	121.41 kcal/1/2 cup
EggPlant Parmesan	383.79 kcal/ 1/24 cut	Marinara Sauce	24.87 kcal/1 fl oz
Buffalo Chicken Wrap	606.52 kcal/1 each	White Rice	111.87 kcal/1/2 cup
Fried Basa w/ Creole Sauce	232.68 kcal/1 serving	Spicy Plum Tofu Slider	227.16 kcal/1 each
California Blend Vegetables	20 kcal/1/2 cup	Tai Chicken Curry	442.04 kcal/1 serving
Grilled Vegetable Skewers	43.45 kcal/1 skewer	Cheesy Lasagna	385.22 kcal/1 serving
Steamed Broccoli Florets	20.46 kcal/1/2 cup	Cranberry-pecan mixed grains	128.26 kcal/1 serving
Antipasto Salad	342.04 kcal/1 serving	Ginger Honey Glazed Carrots	104.47 kcal/1/2 cup
Chicken & Drop Biscuit	370.93 kcal/1 serving	Vege Curry with Jasmine Rice	406.77 kcal/1 serving
Grilled Naan	193.64 kcal/1 each	Chicken & Sausage Paella	493.06 kcal/1 serving
Cheeseburger Pie	609.95 kcal/1/24 cut	Southwest Penne& Black Beans	350.94 kcal/1 serving
Scallion Mashed Potatoes	121.78 kcal/1/2 cup	Italian Roasted Vegetables	99.04 kcal/1/2 cup
Carrots	26.91 kcal/1/2 cup	Steakhouse Potatoes	120.95 kcal/1/2 cup
French Dip AU JUS	7.11 kcal/1 fl oz	Quinoa & Red Pepper Slider	355.62 kcal/2 each
Seasoned Roast Beef	117.51 kcal/3 ozw	General TSO's Chicken	289.77 kcal/1 serving
Cheesy Bean & Rice Burrito	601.84 kcal/1 each	Chipotle BBQ Chicken	180.78 kcal/1 each
Chipotle BBQ Sauce	57.81 kcal/1 fl oz	Cilantro-Lime Rice	75.38 kcal/1/2 cup
Broccoli	19.85 kcal/1/2 cup	Mucho Nachos	724.4 kcal/1 serving
Italian Green Beans	49.07 kcal/1/2 cup	Moroccan Vegetable Stew	383.73 kcal/1 serving
Roasted Potatoes	117.47 kcal/1/2 cup	Sloppy Joe	398.88 kcal/1 each
Spicy Fish Tacos	318.02 kcal/2 each	Garlic Toast	161.91 kcal/2 slices
Rotini Marinara	152.5 kcal/1/2 cup	Italian Roasted Vegetable	99.04 kcal/1/2 cup
Latin Chicken Dinner	422.19 kcal/serving	Thanksgiving Sandwich	304.78 kcal/each
Crispy Deep-Fried Chicken	266.77 kcal/ 1 each	Chicken Tender	46.25 kal/piece
Steamed Green Peas	68.62 kcal/1/2 cup	Meatloaf	244.55 kcal/slice
Tater Tots	220 kcal/44g	Penne Butternut Squash Casserole	396 kcal/ 8 fl oz
Old Bay Potato Chips	308.66 kcal/2ozw	Italian Panini	293.24 kcal/1 each

GRILL			
Meals	**Unit (Each)**	**Side Dish**	**Unit (Each)**
Grilled Cheese Sandwich	302.34 kcal/each	Crispy Shoestring French Fries	261.82 kcal/ 3 ¼ ozw
Turkey burger	303.07 kcal/each	Baked Sweet Potatoes	153.28 kcal/each
Crispy Chicken Sandwich	433.24 kcal/each	Baked Russet Potatoes	136.92 kcal/each
Garden Burger	316.48 kcal/each	Hot Dog	278.58 kcal/each
Grilled Herb Chicken Sandwich	321.17 kcal/each	Chicken Parmesan Slider	217.31 kcal/each
Hamburger	331.35 kcal/each	Chicken Taco Panini	428.01 kcal/each
Bistro Chicken Sandwich	533.71 kcal/each	Reuben Panini	459.34 kcal/each
Spicy Chicken Chipotle Sandwich	547.72 kcal/each	Tuna Melt	429.34 kcal/each
BBQ Chicken Cheddar Sandwich	528.25 kcal/each	Basa Slider	126.41 kcal/each
Chicken & Swiss Sandwich	438.4 kcal/each	Chicago style hot dog	
SALAD			
Vegetables	**Unit**	**Salad Dressing**	Serving size (1oz/spoon)
Mushrooms	10.8 kcal/28g	Honey Mustard	140 kcal/1 oz
Corns	22.67 kcal/28g	Sesame	90 kcal/1 oz
Olives	15 kcal/14g	Ranch	120 kcal/1 oz
Broccolis	9 kcal/28g	Reduced Fat Ranch	80 kcal/ 1 oz
Shredded Carrots	11kcal/28g	Italian	120 kcal/ 1 oz
Sliced Cucumbers	4.3 kcal/28g	French	130 kcal/1 oz
Chopped Onions	11 kcal/28g	Caesar	170 kcal/1 oz
Grape tomatoes	5 kcal/28g	Blue Cheese	150 kcal/1 oz
Lettuce	3.8 kcal/28g	Balsamic Vinaigrette	60 kcal/ 1 oz
Collard Green	8.5 kcal/28g		
Cauliflowers	7 kcal/28g	Fat-free Raspberry Vinaigrette	35 kcal/1 oz
Spinach and Lettuce	6.5 kcal/28g	Raisins	91 kcal/14g
Sliced Tomatoes	5 kcal/28g	Goldfish crackers	65 kcal/14g
Shredded Cheddar Cheese	114 kcal/28g	Rice sticks	47 kcal/14g
Chopped Ham	51 kcal/28g	Croutons	70 kcal/14g
Chopped eggs	44 kcal/28g	Pita Chips	50 kcal/14g
Kidney Beans	44 kcal/28g	Orange	45 kcal/ 1 small
Pickled pepper	11 kcal/28g	Apple	71 kcal/1 medium
Red Potato Salad	280.9 kcal/1/2 cup	Banana	105 kcal/1 medium
Greek Chickpea Salad	100.14 kcal/1/2 cup	Cantaloupe or Honeydew	10 kcal/28g
Curried Vege Bulgur Salad	295.94 kcal/1/2 cup	Peach, Canned	22 kcal/28g
Asian Brown Rice Salad	144.26 kcal/1/2 cup	Water Melon	8.5 kcal/28g
Roasted Vege Bulgur Salad	134.04 kcal/1/2 cup	Seafood Pasta Salad	265.62 kcal/1/2 cup
Curried Quinoa & Butternut Salad	124.91 kcal/1/2 cup	Spicy Sweet Potato Salad	121.18 kcal/1/2 cup
Asian Slaw	37.59 kcal/1/2 cup	Pineapple Chunks, canned	14 kcal/28g
Black bean corn jicama salad	98.37 kcal/1/2 cup	Milk 2% Shamrock	180 kcal/cup
1% Chocolate Shamrock Farms	210 kcal/cup	Milk fat free shamrock Farms	150 kcal/cup
Country Corn Flake	120 kcal/33g	Total Raisin Bran	160 kcal/53g
Reese's Puffs	120 kcal/29g	Rice Chex	120 kcal/31g
Cocoa Puffs	120 kcal/30g	Cinnamon Toast Crunch	130 kcal/31g
Dessert			
Type	**Unit (Piece)**	**Type**	**Unit (Piece)**
Sachima	245 kcal/1 piece (33g)	cake	235 kcal/2.25 oz
Ice Cream Cone	170 kcal/1 each	Pudding	
Cookie	78 kcal/1 each		
Beverage			
Drink	**Unit (12 fl oz cup)**	**Juice and Other**	**Unit (cup)**
Dr Pepper	150 kcal/12 fl oz	Grape Juice Beverage	195 kcal/12 fl oz
Dr Pepper Diet	0	Apple Juice	165 kcal/12 fl oz
Coca-Cola Zero	0	Cranberry Juice Cocktail	170 kcal/12 fl oz
Minute Maid Lemonade	150 kcal/12 fl oz	Premium Orange Blend	165 kcal/12 fl oz
POWERADE	57 kcal/12 fl oz	Iced Tea (unsweetened)	0
Sprite	140 kcal/12 fl oz	Cappuccino-Hot Chocolate	88.67 kcal/ 8 fl oz
Coke Diet	4 kcal/12 fl oz	Cappuccino-French Vanilla	100 kcal/8 fl oz
Coca-Cola	140 kcal/12 fl oz	Cappuccino-Triple Shot Mocha	116.67 kcal/8 fl oz
Coffee	0	Crystal Light-Raspberry ice	7.5 kcal/12 fl oz
Coffee Creamy	15 kcal/1 packet	Crystal light-lemonade	7.5 kcal/12 fl oz
Sugar	23 kcal/1 packet	1% chocolate milk	210 kcal/12 fl oz
2% milk	180 kcal/12 fl oz	Fat free milk	135 kcal/12 fl oz

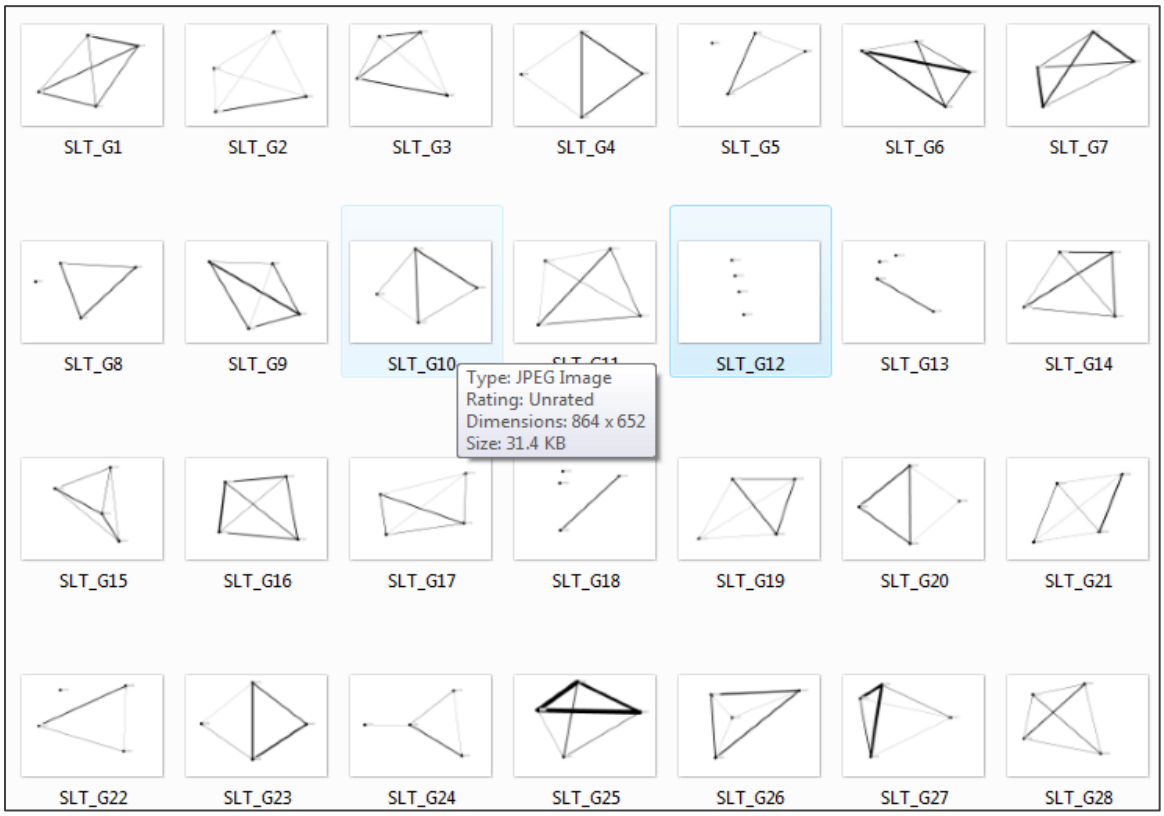
APPENDIX-C

STRENGTH OF TIES AND STRENGTH OF LUNCH TIES FOR 28 GROUPS

1. Strength of ties (weighted) – overview



2. Strength of lunch ties (weighted) – overview



APPENDIX-D

SURVEY APPROVAL

ASU Knowledge Enterprise Development

EXEMPTION GRANTED

Carola Grebitus
Agribusiness, Morrison School of
-
Carola.Grebitus@asu.edu

Dear Carola Grebitus:

On 1/13/2014 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Influence of peer effects and nutrition facts on food choice in dining halls
Investigator:	Carola Grebitus
IRB ID:	STUDY00000484
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Survey instrument dining study Wang and Grebitus IRB track changes_CG.pdf, Category: Consent Form; • Focus Group Survey instrument dining study Wang and Grebitus (2).pdf, Category: Consent Form; • Dining_Study_IRB_02.docx, Category: IRB Protocol; • Email Flyer Focus groupdoc.pdf, Category: Recruitment Materials; • Recruitment script Citrus Dining Hall.pdf, Category: Recruitment Materials;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 1/13/2014.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc:
Dan Wang