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Los Angeles

Association between Work and Dietary Behaviors:

An Exploratory Descriptive Study

A thesis submitted in partial satisfaction

of the requirements for the Master of Science

in Environmental Health Sciences

by

Nathaly Jossabeth Aquino

2019

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ABSTRACT OF THE THESIS

Association between Work and Dietary Behaviors:

An Exploratory Descriptive Study

by

Nathaly Jossabeth Aquino

Master of Science in Environmental Health Science

University of California, Los Angeles, 2019

Professor Wendie A. Robbins, Chair

Health effects at work from exposures to biological, chemical, physical, mechanical, and psychosocial hazards have often been subjects of company safety programs. Nutrition contributes to health, well-being, and productivity at work. Eating a well-balanced diet allows for the body to process nutrients and to maximize them for optimal energy. Poor dietary habits lead to fatigue, decreased mental ineffectiveness, and decreased the ability to perform the job effectively. Nutrition is a function of dietary behaviors and physiological processes that are influenced by the environment, including the work environment. Effects of work on dietary behaviors have been studied in a limited number of occupations, for example, professional drivers and airport personnel. Each individual industry deals with its work environment having different food options

that can influence eating behaviors. Characteristics of work such as shift work, have also been studied and shown to influence the attainment of nutritional goals.

A cross-sectional, descriptive, pilot study was conducted to explore work in relation to patterns of eating and nutritional intake. The aim was to explore work characteristics (hours worked, work setting and job category) in relationship to when, where, and with whom workers ate and to determine whether this was associated with nutritional guideline targets. It was hypothesized that work characteristics would be associated with when, where, and with whom workers ate, and this would influence the attainment of nutritional guideline targets. The goal was to gather information that could provide guidance to employers about work characteristics that facilitate nutritional adequacy and also guide nutrition education for workers to equip them to achieve healthy nutrition.

This explorative, descriptive, pilot study utilized a research data set obtained from 51 healthy, employed men. Work characteristics (hours worked per week, work setting, and the North American Industry Classification System (NAICS) code were collected by a self-report questionnaire. Dietary behaviors were self-reported and categorized as the place food was purchased and consumed (for example, purchased at the supermarket, restaurant, cafeteria, eaten at work, home or car), when meals were eaten (breakfast, lunch, dinner or snack), and whether meals were eaten alone or with others. Nutritional analysis was conducted using the National Institutes of Health (NIH) ASA24, Automated Self-Administered 24-Hour Dietary Assessment Tool. Statistical analysis was conducted using STATA version 16.

Associations were found between several occupational characteristics and dietary patterns. Time as total hours worked per day was inversely correlated with meeting the nutritional goal for grains ($r= -0.37$, $p= 0.01$), and remained significant after controlling for total nutrient intake, $p = 0.001$. Construction workers ($n= 4$) were 2.4 times more likely and information technology workers ($n= 2$) were 3.2 times more likely to purchase their dinner meals at a restaurant compared to professional workers. Other dietary patterns were noted for this population of employed men. Participants did not meet the nutritional guidelines for at least one or more food groups: 90.2% did not meet caloric intake goal, 86.3% were below the grain intake, 94.1% and 82.4% were below the dairy and total fiber intake. Workers eating breakfast somewhere other than home and work were 1.6 times more likely to be under the calorie target. Eating breakfast alone had a correlation with not meeting the dairy targets ($X2$ [4, $N= 44$] = 9.47, $p= 0.05$). The pilot study characterized work in different ways from previous studies and dietary behaviors were studied in great detail using different methods of characterization. With the information learned from this small pilot study, a larger study can be built to focus on high-risk occupations in order to develop ways to help workers meet the nutritional guidelines, and helping achieve the Total Worker Health™ goal.

The thesis of Nathaly Jossabeth Aquino is approved.

Shane S. Que Hee

Michael L. Prelip

Wendie A. Robbins, Committee Chair

University of California, Los Angeles

2019

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To my parents, thank you because without your emotional support I would not be where I am today. Thank you for encouraging me and for not allowing me to give up.

1. INTRODUCTION

1.1 Hypothesis and Aims

The aims of the research were (1) to determine if when, where, and with whom workers ate in a work day varied by the characteristics of work and (2) to determine if attainment of nutritional guideline targets varied across the characteristics of work. The hypotheses were that characteristics of work would be associated with dietary behaviors and would be associated with attainment of nutritional guideline targets.

Figure 1: Hypothesis 1: Characteristics of Work are Associated with Dietary Behaviors

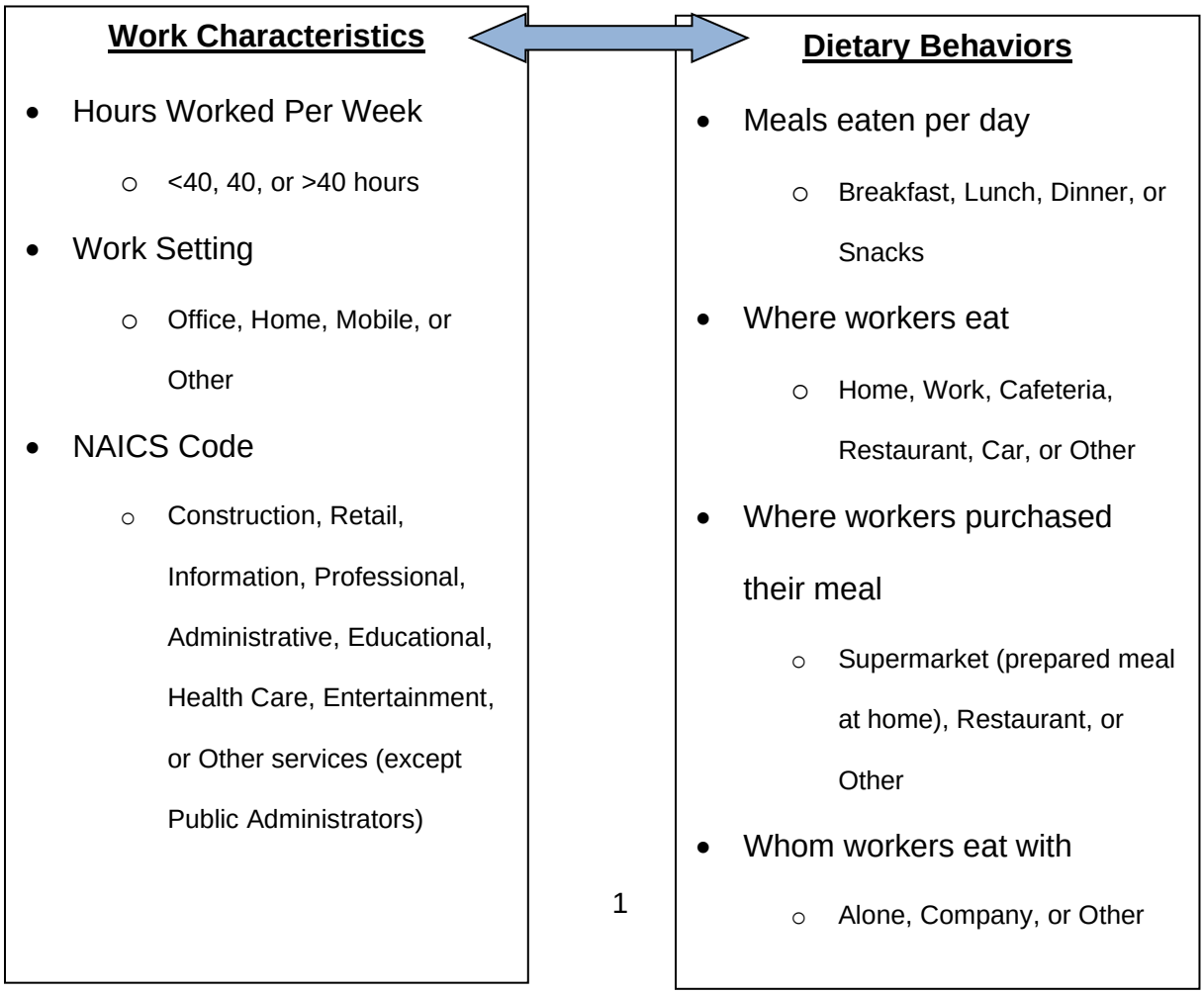
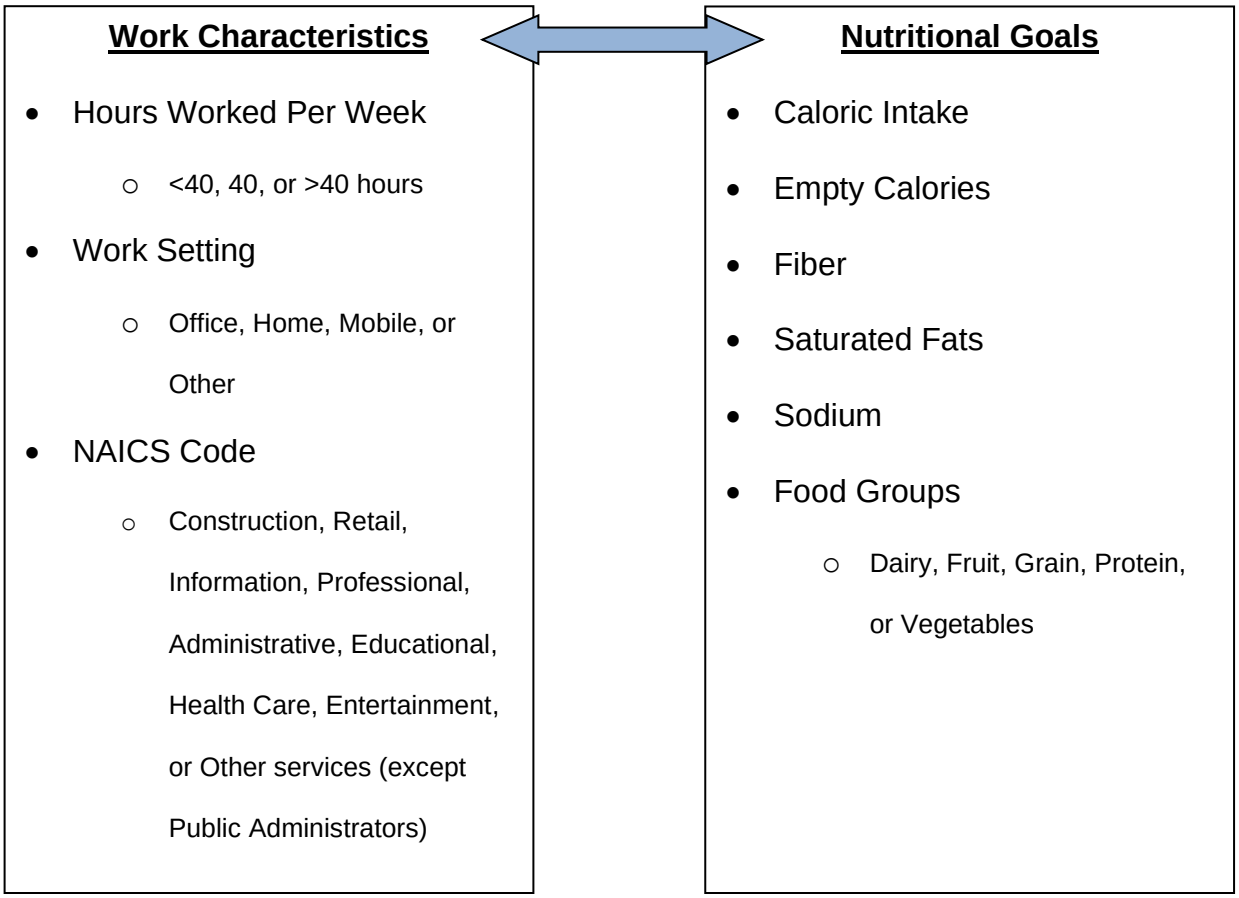


Figure 2: Hypothesis 2: Characteristics of Work are Associated with Attainment of Nutritional Goals



1.2 Background

1.2.1 Work and Dietary Behaviors

Dietary patterns and preferences are associated to an individual's socioeconomic situation (Hulshof *et al.* 2003). Economic factors can result in consumption of less nutritious, energy dense foods because they are cheaper for people to purchase compared to more nutritious foods. . The wage of a worker and cost of food may influence what the worker is eating (Walsh & Nelson 2010; Du Plessis 2011). Cost or

discount, brand, and marketing strategy also influence the purchase of food (Waterlander et al. 2013; Berger et al. 2007; Nie & Zepeda 2011).

Unhealthy diets have been seen more often in people of lower socioeconomic status (SES), which is linked with the factors of education level and income level. SES is related to unhealthy dietary habits because of access and availability of food. In a study reported by Galobardes *et al.* 2001, sugar, fried foods and meat consumption increased as the education level of men decreased. Men with lower education levels consumed less nutrient-dense food. Lower education and occupation independently contribute to dietary habits. In a study of German adults, those with low level of education tended to eat more sugar and fatty foods than adults with higher levels of education (Finger *et al.* 2013). The rich sugar and fatty intake was later found to be associated with higher physical expenditure in occupations endured by workers with lower levels of education. This suggests that workers who are at a socioeconomic disadvantage are already placed at a nutritional disadvantage. A study in France found that education and occupation were independent risk factors for high intake of unhealthy food (Hassen *et al.* 2016). In the United States, individuals with higher SES selected better food choices where the individuals considered the food safety, nutrition, and taste of the food (Wang & Chen 2011). This Unites States study also found that the participants who had higher SES were more aware of health problems associated with unhealthy eating behaviors. However, a study of the Dutch diet found that education but not occupational category was associated with poor diet (Schoufour *et al.* 2018). Many studies have focused on how SES affects an individual's unhealthy eating behaviors. The occupations are categorized as blue collar jobs with very broad classification. A

more detailed analysis on the occupation, which includes classification through a reputable system, needs to be studied. Other working conditions have been shown to affect dietary behaviors for example, shift work (Balierio *et al.* 2014; Knutsson & Boggkid 2010; Koller M 1983) and working hours (Escoto *et al* 2012).

Eating with company or alone is a dietary behavior that has been shown to affect the attainment of adequate nutrition. One study found that the diet quality of people who ate alone versus those who ate with someone was lower (Chae *et al.* 2018). Eating with company offers a chance to try new foods and to have encouragement from others to eat healthy. It is also an opportunity to share time in happiness. Another study offered some explanation for this finding by showing that eating with company was associated with the increased consumption of fruit and vegetables (EUFIC 2005). Eating alone has been linked to having a lower food diversity and depression (Yumi *et al.* 2012). Eating alone does not offer the opportunity to try new food groups or food types in general. The individual stays with the same type of foods they have liked their entire life. The study demonstrated how eating with others is simple and inexpensive to improve mood status and food diversity.

1.2.2 Work-related Dietary Behaviors and Health

The relationship between diet and occupation has been studied in workers who develop nutrition related diseases. Studies have found associations between shift work and gastrointestinal disorders (Knutsson & Boggkid 2010). Working a night affected the diet in a negative way, where workers are more likely to eat less nutrient dense foods. Workers in the oil industry, who are known to rotate schedules and take on extra shifts, have been studied. The prevalence of having gastrointestinal issues was shown to be

higher for night shifts as opposed to day shift workers (Wyse *el al.* 2017; Koller 1983). Another study examined aviation ground employees, agent service and office workers of an airline. A strong association between digestive symptoms (e.g., loss of appetite, bloating, constipation) suggested a stress component related to the occupation (Takaoka *et al.* 2016). Studies have focused on gastrointestinal symptoms and disease. Diet was studied as disease outcomes raised, if no disease or symptom was noted then the workers were deemed to be okay.

Understanding dietary intake and its role in worker's health is important. The literature confirms strong associations between diet and health, such as sodium intake with high blood pressure (Aburto *et al.* 2013) and low vegetable consumption with stroke (He, Nowson & MacGegor 2006). Preventing these types of adverse effects can be achieved, and it can start in the workplace. According to the 2018 Bureau of Labor Statistics, the average American works 42.5 hours per week, or about 8.5 hours per day (Bureau of Labor Statistics 2018). This indicates that the average American worker spends over 1/3 of their day at their workplace. Evidence shows that eating healthy can maintain good health while reducing the risk of chronic disease such as, hypertension, cardiovascular disease and obesity throughout one's lifespan (Healthy People 2020; World Health Organization 2018).

1.2.3 Nutritional Target Guidelines

Dietary guidelines change over the course of the years. The 1990 National Nutrition Monitoring and Related Research Act states that every 5 years the U.S Department of Health and Human Services (HHS) and the U.S Department of Agriculture (USDA) must publish a report containing nutritional and dietary guidelines

for the public. Reviews of current scientific data are taken into account when making a change to the guidelines (Lichtenstein & Karpyn, 2018). For the purpose of this thesis, the guidelines published in the *2015-2020 Dietary Guidelines for Americans* were used. The goal of the guide is to help Americans select a healthy diet with a focus on preventing diet-related diseases.

Table 1: *2015-2020 Dietary Guideline* Targets by Food Group

Food Group	2015-2020 Guideline Target [a/b]
Dairy	3 C
Fruit	2 C
Grain	7.5 oz
Protein	3.5 oz
Vegetable	3 C

[a] C = cup, Oz = ounces. [b] Food intake patterns were taken at 2,200 calories to meet the needs of a male between the age of 31 to 50 years of age.

Table 2: *2015-2020 Dietary Guideline* Targets by Nutritional Goals

Daily Nutritional Goals	Source [a]	2015-2020 Guideline Target [b/c]
Calorie Intake		2,200 kcal
Dietary Fiber	14 g/ 1000 kcal	30.8 g
Empty Calorie [d]		< 380 kcal
Saturated Fat, % kcal	DGA	<10%
Sodium	UL	2,300 mg

[a] 14g fiber per 1,000 kcal = basis for adequate intake for fiber, DGA = *2015-2020 Dietary Guidelines* recommended limit, UL = Tolerable Upper Intake Level. [b] kcal = kilocalorie = 1 calories, g = gram, mg = milligram. [c] Food intake patterns were taken at 2,200 calories to meet the needs of a male between the agesof 31 to 50 years of age. [d] Empty calories are calories derived from food that do not contain nutrients or foods composed primarily of: sugar, fats or oils, or alcohol.

1.2.4 Total Worker Health™

In June 2011, the National Institute for Occupational Safety and Health (NIOSH) launched the Total Worker Health™ program (Schill *et al.* 2013). Total Worker Health™ is an integration of occupational safety and health with the appropriate aspects outside the workplace while promoting overall health and preventing disease.

Worker's health does not just mean protecting the worker from chemical, physical, and biological hazards. Many companies focus on employee protection, worker's compensation, and employee assistance programs. The Total Worker Health™ program helps integrate the protection of employees followed by promoting total health, safety, and well being of the worker; preventing workers from injury and illness that may occur to impair health. These programs help create an environment

where employees may thrive in all areas. For example, access to healthy, affordable food option or prevention of stressful job monitoring programs.

As worker demographics and health insurance cost and productivity shift, employers are beginning to shift their focus. In the past, employers were more concerned with the identification, evaluation and control of exposures to hazards, prevention of injury/ illness/fatality, and risk assessment. New employment patterns such as the global economy and competition for workers have created labor shortages for particular jobs (Canton 2006; Clifton 2011). Population demographics are also changing where there are growing numbers of older workers in the workforce (Hammill 2013). According to the U.S Bureau of Labor Statistics, by 2024 workers age 65 and older are expected to be at 13 million, having a 86% growth when compared to the 5% growth of the labor force as a whole (Toossi and Torpey 2017). Older workers are considered a vulnerable worker population group by NIOSH (Cutter *el al.* 2005). As people age, they can also be at increased risk of inadequate nutrition because of physiological changes such the body's inability to recognize vital deficits like: hunger and thirst (Pilgrim & Robinson 2015), as well as a decrease in absorption of essential nutrients such as vitamins and minerals (Ambrecht *et al.* 1979; Ensrud *et al.* 2000; Veldurthy *et al.* 2016). Given the trends observed in the modern workforce, it is important that human resources and occupational professionals focus on health and productivity management.

A cross-sectional, descriptive, pilot study to explore associations between characteristics of work, patterns of eating (when, where, and with whom workers eat) with attainment of nutritional guideline targets was conducted due to the suggestive

evidence linking health and work productivity with diet. This pilot study was nested within a larger, ongoing study being conducted at a metropolitan ambulatory care clinic in Los Angeles, California. The research was reviewed and approved by the University of California Los Angeles, Human Research Subjects, Institutional Review Board (IRB).

2. METHODS

2.1. Participants

A de-identified data set for this pilot study was drawn from an ongoing research study of male health. There were no records for women in the de-identified data. The final set was composed of records that had complete information for the variables of interest for this thesis research (85% of the existing records). The sample size was determined by the available records with complete data and not an a priori sample size calculation.

The pilot study population was comprised of 51 healthy, employed men who had presented for a health check-up at a large metropolitan ambulatory care clinic. The study population was between the ages of 28 and 55 years old (mean age and standard deviation, 39.7,± 6.4) and 43.1% were White (Non-Hispanic). General characteristics of the study population are shown in Table 3.

Table 3: General Characteristics: Ethnicity, Age, Hours Worked, Work Location, & NAICS code Occupation

Characteristics	n	Percent (%)
Ethnicity	**51**	
Asian	10	19.6
African American	7	13.7
Other	3	5.9
White (Hispanic)	9	17.7
White (Non Hispanic)	22	43.1
Age		
28-37 Years Old	16	31.3
38-47 Years Old	28	54.9
48-57 Years Old	6	11.8
Unknown	1	2.0
Hours Worked		
<40 Hours	6	11.8
40 Hours	33	64.7
>40 Hours	12	23.5
Work Location		
Home	2	3.9
Mobile (Driving around)	2	3.9
Office	37	72.6
Other	10	19.6
NAICS Code for Occupation		
23- Construction	4	7.8
45- Retail Trade	3	5.9
51- Information	2	3.9
54- Professional, Scientific, and Technical	19	37.3
56- Administrative and Support and Waste Management	13	25.5
61- Educational Services	2	3.9
62- Health Care and Social Assistance	3	5.9
71- Arts, Entertainment, And Recreation	1	2.0
81- Other Services (except Public Administrators)	4	7.8

2.2. Questionnaires

2.2.1. ASA24 (Automated Self-Administered 24-Hour Dietary Assessment Tool)

The ASA24 self-report questionnaire was used by participants to report their eating behavior. The ASA24-hour dietary assessment tool is a web-based tool provided by The National Cancer Institute (NCI) to the research community (National Cancer Institute 2019). The ASA24 tool is used for 24-hour recalls and is also known as food diaries. The records obtained from the study participants were used to create a complete nutrient analysis for one working day. Only one working day was collected because, it was the only data available at the time of the pilot study. Caloric intake by meal, daily calorie consumption and allowed, daily food group targets (target, consumed, and status), and nutrients intake (target, consumed, and status) were provided in the nutrient analysis participant profile.

The questionnaire specified meals as breakfast, lunch, dinner, or snacks. Participants were asked to specify date and time of meals. The participants were asked to choose from drop-down lists the location of meals, the type and portion of food or beverage they consumed, where they purchased their food and whether they ate alone or with someone. Participants were asked to report if they took any supplements during that 24-hour eating period.

2.2.2. International Physical Activity Questionnaire (IPAQ)

The International Physical Activity Questionnaire (IPAQ) is a self-administered questionnaire developed in Geneva in 1998 which underwent reliability and validity testing across many countries during 2000 (Scienze della prevenzione 2002). Job title was collected as part of the International Physical Activity Questionnaire (IPAQ)..

The IPAQ collected self-report data on physical activity done by participants over a seven-day span. Participants were asked to think about activities they performed at work, home, or while getting from one place to another. Participants were asked to classify their activities as vigorous, hard physical effort that made them breathe harder than normal, or as moderate, moderate physical effort that made them breathe somewhat harder than normal.

2.3. Characterizing Occupation

Occupation was characterized based upon time factor (hours worked: <40, 40, >40) and setting (home, office, mobile, or other). Time factor was important for understanding how long the individual spent at their job.

Occupations were categorized using the North American Industry Classification System (NAICS) Occupation. This classification system was developed as a standard for use by Federal statistical agencies in classifying occupations (NAICS Association 2018). The main purpose of NAICS is to standardize occupational descriptors so as to collect and make available to the community statistical data relating to the economic status of the United States. NAICS is managed by the Census Bureau.

2.4. Variables of main interest

The independent variables of main interest were work characteristics. The population was categorized by: hours worked per week (<40, 40 or >40), work location (home, office, mobile, or other) and NAICS code occupation.

The dependent variables of interest were dietary behaviors, defined as when, where, what, and with whom workers ate in a 24-hour work day and attainment of nutritional guidelines. The dietary data were entered into the online ASA24 program. Participants entered the food, drink, vitamins and supplements consumed at each meal period (breakfast, lunch, dinner, and snacks). They entered the time that each meal or snack began. Where the meal was eaten was categorical and chosen from a drop-down menu that included home, work (cafeteria, work station, other), cafeteria not at work, restaurant, fast food restaurant, car, and other. The participant chose whether they ate with someone (yes/no).

Participant's age and race/ethnicity was also assessed to see if it played a role in the dependent variables and to understand the study group.

2.5. Nutritional Goals & Food Groups of Interest

The nutritional goals of interest are calorie intake, dietary fiber, empty calorie, saturated fat, and sodium. All the nutrients are part of the *2015-2020 Dietary Guidelines for Americans*, but further the purpose of the study emphasis was placed on five specific nutrients. Calorie intake was selected to look at the overall consumption of food; the body needs calories to work appropriately. Calorie consumption to low or too high will lead to health problems. Empty calories, are calories that are poor in nutrients meaning they lack the adequate vitamins and minerals. Empty calories can indicate if the individual is eating high amounts of sugar, fat, or alcohol. Dietary fiber is a good indicator to see if an individual is eating a diet rich in fruits, vegetables, grains, or beans. Consuming high amount of saturated fats can lead to health issues in the blood.

Saturated fats should be limited and instead replaced with health fats. Lastly sodium was selected to be analyzed; sodium is import in the body's fluid balance and most importantly associated with hypertension, a well studied disease linked to sodium. Eating high amounts of sodium may indicate consumption of processed foods, which is important to understand.

The food groups analyzed are dairy, fruit, grain, protein, and vegetable. All five groups were selected because they are all part of the *2015-2020 Dietary Guidelines for Americans*. No further emphasis was placed since there were only five groups.

2.6. Statistical Analysis

Data were analyzed using STATA, statistical software version 16. Descriptive statistics are reported as mean and standard deviation (std) for normally distributed data, otherwise as counts and percent. The Shapiro-Wilk test was used to assess for normality within the data. Pearson's chi squared tests and Spearman's rank correlations were used for tests of association, the latter for non-normal data sets. Chi square tests with $p < 0.05$ and correlation coefficients >0.30 were explored further using binomial or multinomial logistic regression. A $p < 0.05$ was considered significant.

3. RESULTS

Only age was normally distributed, all other variables studied were not normally distributed.

3.1. Work and Dietary Behaviors: When, Where, and With Whom

No statistically significant relationships were found between characteristics of work (hours worked, setting, NCAIS code occupation) and demographic variables for the study population (age and race/ethnicity), p >0.05. Of the 51 participants, 44 (86.3%) ate breakfast, 46 (90.2%) ate lunch, and all reported eating dinner. The majority ate breakfast and dinner at home, 27 (61.4%) and 34 (66.7%) respectively, with food that had been purchased at a supermarket and prepared at home. Prepared at home was gathered from the ASA24 questionnaire. The location of where eating lunch occurred varied with 18 (39.1%) reporting eating lunch at their worksite (Table 4). Where meals were eaten and work setting were explored. The office work setting showed a significant association with where workers ate lunch (r= 0.40, p= 0.01). Out of the 46 workers who reported that they ate lunch, 34 worked in an office. Most office workers ate lunch at work (47.1 %), followed by 17.6% at home; the remaining places for lunch were distributed between car, cafeteria, or restaurant. Where meals were eaten was also associated with NAICS code occupation. A significant association was found for NAICS code occupation and location of the dinner meal (multinomial logistic regression, p= 0.001). Construction workers were 2.4 times more likely and information technology workers were 3.2 times more likely to purchase their dinner meal at a restaurant compared to professional workers. Professional workers tended to purchase their dinner food at a supermarket, prepare, and eat dinner at home. Place where meals were eaten was not shown to be associated with the work characteristic of hours worked.

Table 4: Results from Breakfast

Variable	N	Frequency	Percent
Breakfast			
Did they eat Breakfast?	51		
Yes		44	86.3
No		7	13.7
Where did they eat Breakfast?	44		
Home		27	61.4
Work		10	22.7
Cafeteria		1	2.3
Fast Food Restaurant		2	4.6
Car		4	9.1
Other		0	0.0
Where they purchased their Breakfast?	44		
Supermarket		35	79.5
Restaurant		6	13.6
Other		3	6.8
Did they eat alone?	44		
Yes		28	63.6
No		15	34.1
Unknown or Missing		1	2.3

Table 5: Results from Lunch

Variable	N	Frequency	Percent
Lunch			
Did they eat Lunch?	51		
Yes		46	90.2
No		5	9.8
Where did they eat Lunch?	46		
Home		11	24.0
Work		18	39.1
Cafeteria		2	4.4
Fast Food Restaurant		3	6.5
Car		1	2.2
Other		11	23.9
Where they purchased their Lunch?	46		
Supermarket		26	56.5
Restaurant		17	37.0
Other		3	6.5
Did they eat alone?	46		
Yes		19	41.3
No		20	43.5
Unknown or Missing		7	15.22

Table 6: Results from Dinner

Variable	N	Frequency	Percent
Dinner			
Did they eat Dinner?	51		
Yes		51	100.0
No		0	0.0
Where did they eat Dinner?	51		
Home		34	66.7
Work		2	3.9
Cafeteria		1	2.0
Fast Food Restaurant		1	2.0
Car		1	2.0
Other		12	23.5
Where they purchased their Dinner?	51		
Supermarket		32	62.8
Restaurant		17	33.3
Other		2	3.9
Did they eat alone?	51		
Yes		5	9.8
No		40	78.4
Unknown or Missing		6	11.8

Total hours worked per day was inversely, moderately correlated with whether a worker ate breakfast, (r= -0.32, p= 0.02). There was no statistically significant relationship between total hours worked and NAICS code occupation or work setting. None of the work characteristics were significantly associated with whom the worker ate their meals.

3.2 Work and Attainment of Nutrition

No statistically significant relationships were found between attainment of nutritional goals and age, and race/ethnicity of the study population, p >0.05. The study indicated that all participants who reported their dietary intake were inadequate in one or more nutritional groups. Ten participants (19.6%) exceeded the intake guideline for

total calories and 36 (70.6%) were under the caloric intake guideline. For grains, 86.3% were below the grain intake guideline; for dairy, 94.1% were below the guideline;, and for fiber, 82.4% were below the intake guideline. Thirteen participants (25.5%) exceeded the guideline for empty calories and saturated fat, and 68.6% exceeded the sodium intake. Table 5 demonstrates participants' attainment of nutrition throughout all nutritional groups studied.

Table 7: Attainment status of Nutritional Groups using the *2015-2020 Dietary Guidelines*

Nutritional Group	Under (%)	Okay (%)	Over (%)
Total Calorie [a]	36 (70.6)	5 (9.8)	10 (19.6)
Grains	44 (86.3)	7 (13.7)	—
Vegetables	39 (76.5)	12 (23.5)	—
Fruit	40 (78.4)	11 (21.6)	—
Dairy	48 (94.1)	3 (5.9)	—
Protein	22 (43.1)	29 (56.9)	—
Empty Calorie [b]	—	38 (74.5)	13 (25.5)
Saturated Fat	—	38 (74.5)	13 (25.5)
Sodium	—	16 (31.4)	35 (68.6)
Total Fiber	42 (82.4)	9 (17.6)	—

[a] Total Calories for a man between 26-40 years of age is between 2,400 and 2,600 calories. The Total Calories for a man between 41-55 years of age is between 2,200 and 2,400 calories. The values were gathered from the *2015-2020 Dietary Guidelines*. [b] Empty calories are calories derived from food that do not contain nutrients or foods composed primarily of: sugar, fats or oils, or alcohol.

Associations between work characteristics and attainment of nutrient goals were explored. Hours worked and meeting the goal for grains (yes/no) had a moderate inverse relationship (r= -0.37, p= 0.01), that remained after controlling for total caloric intake in logistic regression, p = 0.001. Work hours were not correlated with the attainment of the following nutritional groups: total calories, empty calories, total fiber,

saturated fat, fruit, vegetable, dairy or protein, p >0.05. A significant association was found for NAICS code occupation and empty calories (multinomial logistic regression, p= 0.000); total calories were controlled. Health care and social services and retail workers were 4.3 times less likely to exceed the empty calorie goal compared to the NAICS category of administrative workers.

Although not associated with any of the specific work characteristics, breakfast was found to have a significant role in meeting dietary targets for this group of workers. A strong inverse correlation was found between eating breakfast at home and total calorie intake for the day (multinomial logistic regression, p= 0.007). Workers eating breakfast somewhere other than home and work were 1.6 times more likely to be under the calorie goal when compared to eating at home. Eating breakfast at home had a moderate inverse correlation with sodium (r= -0.31, p= 0.04).

Where breakfast was purchased was associated with meeting the total fiber goal (multinomial logistic regression, p= 0.002); total calories were controlled. Among those who ate breakfast, 91% who purchased breakfast from the supermarket met the fiber goal compared to 100% of those who purchased breakfast places other than the supermarket. Eating breakfast alone had a moderate positive correlation with not meeting the dairy nutritional target (X^2 [4, N= 44] = 9.47, p= 0.05). Workers who ate alone ate between 0-1.9 cups of dairy a day.

4. DISCUSSION

4.1. Findings

Research findings indicated that some, though not all; occupational characteristics were associated with dietary behaviors and were associated with attainment of nutritional goals. Total hours worked per day was inversely correlated with grain attainment, (p= 0.01). The finding of inadequate grain consumption with longer hours worked suggests that when employees worked longer hours, they are likely to not meet the nutritional goal of 7.5 oz of grain per day. This finding supports that lower SES, groups had significantly lower grain intake than those from more advantaged individuals (Mann 2015; Galobardes *et al.* 2001). However, individual occupations were not assessed. Previous studies have been broken down in shift work with the amount of days worked as opposed to the study that was broken into hours worked.

Based on NAICS categories, the place where workers ate dinner was associated with meeting dietary guidelines. Construction and information technology workers were more likely to eat dinner at restaurants than the other NAICS job categories and were found to consume more sodium than recommended (3,201 mg per day) and exceeded the guideline of < 2,300 mg per day. Some 75% of construction workers and 100% of information technology workers did not meet the total fiber guideline. The observations support the Schulte 2007, study where construction workers were observed to have poor nutrition. However, papers on information technology workers were not found, especially when using the NAICS code.

Although not associated with work characteristics, this study found that eating alone was associated with failure to attain adequate dairy intake (p=0.001). The data supports the paper that showed that eating with company was associated with healthier choices for the dairy intake (Chae *et al.* 2018). Additionally, for the workers in the

present pilot study, eating dinner with others was associated with consumption of more protein compared to workers who ate alone, p= 0.04.

To collect all the food data the ASA24 dietary assessment tool was used as oppose to a food frequency questionnaire (FFQ). FFQ were widely used in epidemiological studies; however in the 2000 doubts of accuracy were raised in studies (Schatzkin *et al.* 2003; Freedman *et al.* 2006). The dietary assessment is more open ended questions that collect information that has occurred in the day as oppose to the FFQ that requires for the participant to recall from over a week. More concrete data may be collected on the 24 dietary assessments. However, there is still a chance with the ASA24 that the participants memory may not recall properly. With proper training the ASA24 can offer data with little bias. The ASA24 has also been standardized and helps reduce interviewer bias since participant can do it at the comfort of their home.

4.2. Limitations

The study used a small sample size and existing data set which is not representative of the entire American population of workers and that limited statistical power in all areas. A larger study population based on a priori sample size calculations is recommended for a further study. Purposive sampling to better represent a distribution of occupations would also provide better representation.

The study utilized the ASA24-hour dietary assessment to collect dietary information and this tool has been shown to be valid for general categories of food groups and nutrients, capturing ~80% of food actually consumed (Kirkpatrick *et al.* 2014). The use of forced-choice drop-down lists may have been a possible limitation. For example, for categories such as where workers ate lunch, “other” was selected a

majority of the time which limits more in-depth exploration of associations. . There is also a limitation that ASA24 method is focused on short-term intake. The ASA24-hour dietary assessment data that was used for this pilot work represented one work day, which may not be an accurate representation of usual workday eating. However, it has been suggested in the literature that episodically consumed foods are better addressed with statistical techniques than averaging multiples of 24-hour intakes (Dodd *et al.* 2006). Small sample size limits these techniques in the current study. Additionally, each participant was asked to remark on whether that particular day was typical of their daily eating. The ASA24 and IPAQ questionnaires are based on self-report, and therefore, biases of under reporting for fear of recall error may have occurred. The results of the study may underestimate associations between work characteristics and diet.

Although many limitations were identified, the study also had its strengths. The pilot study characterized work in different ways from previous studies and dietary behaviors were studied in great detail using different methods of characterization. The thesis also used the validated ASA24 dietary assessment tool which has been shown to be more accurate for recall of dietary intake than food frequency questionnaire. The information gained can be further applied to a larger population size.

4.3. Recommendations

Implementation of nutrition programs to increase adherence to nutritional guidelines would be beneficial for worker total health. Due to the rise of nutrition related diseases, it is important to protect the workforce. As our workforce ages, it is important to keep elders healthy. Simple changes, such as substitution to food that worker has

access to. For example, adding more nutritionally dense food to the vending machine in the break room or having a cafeteria provide healthier options in meal selection.

Further analysis of larger data sets to explore relationships between occupation and diet should be conducted as this thesis does not represent all occupations, nor were the numbers the same in each occupation. . Studying individual occupations from this thesis and doing a complete analysis would provide vital information on what occupations should be focused on.

Understanding that occupational hazards do not just come from physical, chemical, biological, mechanical and psychosocial sources is important. American workers spend over a third of their day at their job; workplaces should be providing an environment where workers can thrive and be healthy. This environment should include considering the effect of work on diet and vice versa.

5. CONCLUSION

Employees spend over one third of their life in their workplace (Bureau of Labor Statistics 2018). In an aging workforce, nutritional deficiencies become more prevalent, and ways to prevent these deficiencies are important. This thesis focused on characterizing different aspects of occupation, based upon time factor (hours worked), setting (home, office, mobile, or other), and NAICS code occupation with dietary behaviors (when, where, and with whom workers ate) in a 24-hour work day. The study found that grain attainment was less likely to be met the more hours an employee worked. The comparison between occupations was statistically significant when using NAICS code occupations and attainment of nutritional guidelines. Construction and

information technology were two occupations identified that did not meet fiber or sodium guidelines which was attributed to the behavior of going out to eat. The study found, that eating breakfast alone was associated with failure to meet the diary guidelines. The prevention of nutrition related disease caused by dietary behaviors can be addressed by educating our workforce, and taking into account the characteristic of each occupation. The data collected should be expanded upon to gather a more holistic study. With the information gained from the present study, a larger study can be built to focus on high risk occupations to develop ways to help workers meet the guidelines, and helping to achieve the Total Worker Health™ goals.

LIST OF REFERENCES

1. Aburto N. J., Ziolkovska A., Hooper L., Elliott P., Cappuccio F. P., Meerpohl J. J. (2013). Effect of lower sodium intake on health: Systematic review and meta-analyses. *BMJ (Clinical Research ed.)*, 346, f1326. Doi:10.1136/bmj.f1326

2. Ambrecht, H. J., Zenser, T. V., Bruns, M. E., Davis, B. B. (1979). Effect of Age on Intestinal Calcium Absorption and Adaptation of Dietary Calcium. *American Journal of Physiology*, 236, 769-774. Dio: 10.1152/ajpendo.1979.236.6.E769

3. Balieiro L. C., Rossato L. T., Waterhouse J., Paim S. L., Mota M. C., Crispim C. A. (2014). Nutritional status and eating habits of bus drivers during the day and night. *Chronobiology International*, 31, 1123–1129. Doi:10.3109/07420528.2014.957299

4. Berger, J., Draganska M., Simonson, I. (2007). The Influence of Product Variety on Brand Perception and Choice. *Marketing Science*, 26, 460-462. Doi: https://doi.org/10.1287/mksc.1060.0253

5. Chae, W., Ju, Y. J., Shin, J., Jang, S., Park, E. (2018). Association between Eating Behavior and Diet Quality: Eating Alone vs. Eating with Others. *Nutrition Journal*, 17, 117. Doi: https://doi.org/10.1186/s12937-018-0424-0

6. Cerin, E., Cain, K.L., Oyeyemi, A., Owen, N., Conway, T.L., Cochrane, T., van Dyck, D., Schipperijn, J., Mitaš, J., Toftager, M., Aguinaga-Ontoso, I., and Sallis, J.F. (2016). Correlates of agreement between accelerometry and self-reported physical activity. *Medicine and Science in Sports and Exercise*, 48, 1075-1084.

7. Cutter, S., Boruff B. J., Shirley, W. L. (2005). Social Vulnerability to Environmental Hazards. *Social Science Quarterly*, 84, 242-261. Doi: https://doi.org/10.1111/1540-6237.8402002

8. Diet, nutrition and the prevention of chronic diseases. Report of a WHO's Group. Geneva. World Health Organization, (2003). *WHO Technical Report Series*, No. 916, 1-160.

9. Dodd, K. W., Guenther P. M., Freedman L. S., Subar, A. F., Kipnis, V., Midthune D., Tooze J. A., Krebs-Smith S. M. (2006). Statistical Methods for Estimating Usual intake of nutrients and foods: a review of the theory. *Journal of American Dietetic Association*, 106, 1640-50. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/17000197/

10. Du Plessis, K. (2012). Factors Influencing Australian Construction Industry Apprentices' Dietary Behaviors. *American Journal of Men's Health*, 6. 59-66.

11. Ensrud, K. E., et al. (2000). Low Fractional Calcium Absorption increases the Risk for Hip Fracture in Women with Low Calcium intake. Study of Osteoporotic Fractures Research Group. *Annals of Internal Medicine*, 132, 345-353.

12. Escoto K. H., Laska M. N., Larson N., Neumark-Sztainer D., Hannan P. J. (2012). Work hours and perceived time barriers to healthful eating among young adults. *American Journal of Health Behavior*, 36, 786–796. Doi:10.5993/ajhb.36.6.6

13. European Food Information Council. (2005). The Determinants of Food Choices. Retrieved from http://www.eufic.org/article/en/expid/review-food-choice/

14. Finger, J. D., Tylleskar, T., Lampert, T., Menink G. B. M. (2013). Dietary Behavior and Socioeconomic Position: The Role of Physical Activity Patters. *PLos One*. Doi: 10.1374/journal.pone.0078390

15. Freedman, L. S., Potischman, N., Kipnis, V., Midthune D., Schatzkin, A., Thompson, F. E., Troiano, R. P., Prentice R., Patterson R., Carroll R., Subar A. (2006). A comparison of two dietary instruments for evaluating the fat-breats

cancer relationship. International Journal of Epidemiology, 35, 1011-1021. Retrieved from https://academic.oup.com/ije/article/35/4/1011/686387

16. Galobardes, B., Morbia, A., Bernstein, M. S. (2001). Diet and Socioeconomic Position: Does the use of Different indicators matter? *International Journal of Epidemiology*, 30, 334-340. Doi: https:doi.org/10.1093/ije/30.2.334

17. Hassen, W. S., Castebon, K., Cardon P., *et al.* (2016). Socioeconomic Indicators Are Independently Associated with Nutrient Intake in French Adults: A DEDIPAC Study. *Nutrients*, 8, 158. MDPI AG. Retrieved from http://dx.doi.org/10.3390/nu8030158

18. He F. J., Nowson C. A., MacGregor G. A. (2006). Fruit and vegetable consumption and stroke: Meta-analysis of cohort studies. Lancet (London, England), 367, 320–326. Doi:10.1016/s0140-6736(06)68069-0

19. Hulshof, K. F., Brussaard J. H., Kruizinga, A. G., Telman J., Lowik M. R. (2003). Socio-economic status, dietary intake and 10 y trends: the Dutch National Food Consumption Survey. *European Journal of Clinical Nutrition*, 57, 128-137. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/12548307

20. Kant, A. K. (2000). Consumption of Energy-dense, Nutrient-poor Foods by Adult Americans: Nutritional and Health Implications. The third National Health and Nutrition Examination Survey, 1988-1994. *The American Journal of Clinical Nutrition*, 72, 929-936. Doi:10.1093/ajcn/72.4.929

21. Kirkpatrick, S., Subar, A., Douglass, D., Zimmerman, T. P., Thompson, F. E., Kahle, L. L., George, S. M., Dodd, K. W., Potischman, N. (2014). Performance of the Automated Self- Administered 24-hour Recall relative to a measure of true intakes and to an interviewer-administered 24-h recall. *American Journal of Clinical Nutrition*, 100, 233--240. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4144101/

22. Koller, M. (1983) Health Risk related to Shift Work. An example of Time-contingent effects of Long-term Stress. *International archives of Occupational and Environmental Health*, 53, 59-75. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/11010933https://www.ncbi.nlm.nih.gov/pubmed/6654503

23. Knuttson, A., & Bogglid, H. (2010) Gasteriointestinal disorders among shift workers. Scandinavian *Journal of Work Environment & Health*, 36, 85-95. Retrieved from http://www.sjweh.fi/show_abstract.php?abstract_id=2897

24. Lichtenstein, A. H., & Karpyn, A. (2018). History and Development of the 2015-2020 Dietary Guidelines for Americans. *Oxford Scholarship.* Doi: 10.1093/oso/9780190626686.003.0002

25. NAICS Association. (2018). About NAICS Association. *NAICS Association*. Retrieved from https://www.naics.com/who-we-are/

26. National Cancer Institute. (2019). Automated Self-Administered 24-Hour (ASA24®) Dietary Assessment Tool. *National Cancer Institute, Division of Cancer Control & Population Sciences*. Retrieved from https://epi.grants.cancer.gov/asa24/

27. Nie, C. & Zepeda L. (2011). Lifestyle Segmentation of US Food Shippers to Examine Organic and Local Food Consumption. *Appetite*, 57, 28-37. Doi: 10.1016/j.appet.2011.03.012

28. Pilgrim, A., Robsinson, S. (2015). An Overview of Appetite Decline in Older People. *Nursing Older People*, 27, 29-35. Doi: 10.7748/nop.27.5.29.e697

29. Sallis (2016). International Physical Activity Questionnaire (IPAQ). *University of California, San Diego*. Retrieved from http://sallis.ucsd.edu/measure_ipaq.html

30. Schatzkin, A., Kipnis, V., Carroll, R. J., Midthune D., Subar, A. F., Bingham, S., Schoeller, D. A., Troiano, R. P., Freedman, L. S. (2003). A comparison of a Food Frequency Questionnaire with a 24-hour recall for use in an epidemiological cohort study: results from the biomarker-based Oberserving Protein and Energry Nutrition Study. *International Journal of Epidemiology*, 32, 1054-1062. Retrieved from https://academic.oup.com/ije/article/32/6/1054/775173

31. Schill, A. L. (2013). The NIOSH Total Worker Health™ Program: An Overview. *Journal of Occupational and Environmental Medicine*, 55, S8-S11. Doi: 10.1097/JOM.0000000000000037

32. Schoufour, J. D., de Jonge, E. A. L., Jong, J. C. K., *et al.* (2018). Socio-economic Indicators and Diet Quality in an Older Population. Maturitas, 107, 71-77. Retrieved from https://doi.org/10.1016/j.maturitas.2017.10.010

33. Scienze della prevenzione. (2002). International Physical Activity Questionnaire. Retrieved from http://www.sdp.univ.fvg.it/sites/default/files/IPAQ_English_self-admin_long.pdf

34. StataCorp. 2017. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC

35. Takaoka, M., Lindgren, T., *et al.* (2016). Digestive Functional Symptoms among Groung Employees in an Airline Company in Relation to Diet, Insomnia and Lifestyle Factors. *Canadian Center of Science and Education*. Retrieved from https://pdfs.semanticscholar.org/5d7d/c4dadad57b8f553e894e7157eb147f5e2530.pdf

36. Toosi M., Torpey E. (2017). Older Workers: Labor force trends and career options. United States Department of Labor, Bureau of Labor Statistics. Retrieved from https://www.bls.gov/careeroutlook/2017/article/older-workers.htm

37. United States Department of Health and Human Services and US Department of Agriculture. 2015-2020 Dietary Guidelines for Americans December 2015. Retrieved from https://health.gov/dietaryguidelines/2015/

38. United States Department of Labor. Bureau of Labor Statistics. Retrieved from https://www.bls.gov/charts/american-time-use/emp-by-ftpt-job-edu-h.htm

39. Veldurthy, V. et al. (2016). Vitamin D, Calcium Homeostasis and Aging. *Nature*, 4, 16041. Retrieved from https://www.nature.com/articles/boneres201641

40. Walsh, A., Nelson, R. (2010). The link between diet and health: An exploratory study of adolescents in Northern Ireland using foodmaps. *International Journal of Consumer Studies*, 34, 190-195. Retrieved from https://www.researchgate.net/publication/229946354_The_links_between_diet_and_health_An_exploratory_study_of_adolescents_in_Northern_Ireland_using_foodmaps

41. Wang Y., Chen X. (2011). How Much of Racial/Ethnic Disparities in Dietary Intakes, Exercise, and Weight Status Can Be Explained by Nutrition and Health-Related Psychosocial Factors and Socioeconomic Status among US Adults?. *Journal of American Dietetic Association*, 111, 1904-1911. Retrieved from https://www.sciencedirect.com/science/article/pii/S0002822311016580#tblfn4

42. Waterlander, W. E., *et al*. (2013). Price Discounts Significantly Enhance Fruit and Vegetable Purchases when Combined with Nutrition Education: A Randomized Controlled Supermarket Trial. *American Journal of Clinical Nutrition*, 97, 886-895. Dio: 10.3945/ajcn.112.041632.

43. Yumi, K., Wanda, T., Okumiya, K., Ishimoto , Y., Fukutomi, Y., Kasahara, W., Chen, R., Sakamoto, M., Fujisawa, K., Otsuka, K., Matsubayashi, K. (2012). Eating Along Among Community-Dwelling Japanese Eldererly: Association with Depression and Food Diversity. *The Journal of Nutrition, Health & Aging*, 16, 728-729. Retrieved from https://link.springer.com/article/10.1007%2Fs12603-012-0067-3