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Nutrition and Physical Activity Recall to Assess the Health Status of Commuters and Residents
on a College Campus

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Abstract

Introduction: Behavioral patterns acquired in college may contribute to overweight and obesity later in life. Food found in college dormitories and dining halls are those of convenience.

Physical activity and a healthy diet are important components to maintaining a healthy weight.

Research Questions: The purpose of this study is to investigate if residency during college and access to kitchen appliances impacts students' dietary composition and physical activity levels and other health behaviors.

Methodology: 38 students (27 residents and 11 commuters) from Merrimack College participated in the study. These participants were recruited through convenience sampling on campus. All participants completed a nutrition and physical activity questionnaire as well as a 3-day dietary food log.

Results: There was statistical difference among students with different living situations and the amount of times they cook meals at home, as well as the amount of times that they ate at the school cafeteria per week. Residents spent more money and ordered takeout more frequently than commuters.

The dietary food logs showed significant difference between the means of the consumption of total carbohydrates and total sugars between residents and commuters.

Conclusion: The most important finding of the current study is that residency and access to kitchen appliances in college does contribute to the overall health of college students.

Introduction

College students often experience weight gain, and behavioral patterns that can contribute to becoming overweight, and sometimes obese during adulthood. Physical activity and a healthy diet are recommendations to help reverse the increasing prevalence of becoming overweight and even obese among adolescents and adults in the United States. The purpose of this paper is to determine if living arrangements and availability to kitchen appliances influence dietary choices and other health behaviors among college students. The greatest increases in individuals who are overweight and obese seem to occur in persons between the ages 18 and 29 years, based upon results of the Behavioral Risk Factor Surveillance System in a study conducted by Racette et al (2005). It is crucial to assess diet and physical activity in this age group so college students do not go onto to contribute to the obesity epidemic.

Literature Review

Nutrition on Health. Nutrition is a key factor to increase the healthy lifespan for Americans. The quality of one's diet can have a physical, mental and social effect on their health. A proper diet gives the human body the necessary components to function efficiently. Consider that in light of Webster's definition of medicine: "*The science and art dealing with the maintenance of health and the prevention, alleviation, or cure of disease.*" The food we eat acts as medicine - to maintain, prevent and treat disease.

The negative effects that unhealthy lifestyle choices have on our nation is a growing concern. About half of all American adults - 117 million individuals - have one or more preventable chronic diseases, many of which are related to poor diet and physical activity (US Department of Agriculture, 2015-2020). Some of the most common preventable chronic diseases

are: cardiovascular disease, high blood pressure, type 2 diabetes, and obesity. According to the Center for Disease Control (CDC), more than two-thirds of adults are overweight or obese.

These rates have continued to grow over the past two decades and not only come with increased health risks, but also at a high cost.

In the US, the presence of multiple chronic conditions has steadily risen from 21.8% in 2001 to 26.0% in 2010 (Sambamoorthi et al., 2015). According to the CDC, nearly 78% of all healthcare expenses are for the treatment of chronic diseases. In the United States, chronic diseases conditions and the health risk behaviors that cause them account for the most health care costs. These costs can be reduced by improving the quality of health among Americans by addressing health behaviors i.e., diet and physical activity.

The analysis directed by Krebs-Smith et al (2010) indicates that nearly the entire U.S. population consumes a diet with fewer vegetables and whole grains than recommended and that a large majority under consume fruits, milk, and oils relative to recommendations. The Federal Government has created *The Dietary Guidelines for Americans*, as a critical tool for Americans to make healthy choices that promote overall health and help prevent chronic diseases.

According to the FDA, the key recommendations for a healthy eating pattern include: a variety of vegetables for all of the subgroups, fruits (whole fruits especially), grains, at least half of which are whole grains, fat-free or low-fat dairy, including milk, yogurt, and cheese, a variety of proteins, including seafood, lean meats, poultry, eggs, legumes, nuts, seeds, soy products, and oil. A healthy eat pattern limits saturated fats, trans fats, added sugars and sodium. If alcohol is consumed it is recommended to be consumed in moderation - up to one drink per day.

Nutrition on College Campuses. Behavioral patterns acquired in college may contribute to overweight and obesity in adulthood if not careful. The college environment promotes change in many aspects of students' lives. College students face time constraints because of their busy workloads which often leads to choose foods based off of convenience. Cooking healthy meals requires time, energy and access to the tools that majority of college students lack.

Food found in college dormitories are those of convenience, they can be cooked in a microwave or toaster oven as quick on-the-go snacks. Nelson and Story (2009) conducted a study at a public university where more than 70% of students had each of the following types of items found in their door room: salty snacks, cereal, granola, microwave dishes, desserts or candy, and sugar-sweetened beverages. Despite being actively enrolled in full-service meal plans college students continue to maintain a wide variety of snacks and beverages in their dorm rooms.

The incidence of obesity has increased parallel with increasing portion sizes. Campus dining halls hold a variety of foods that are readily available to students at their convenience. Wansink & Van Ittersum (2007) demonstrated that convenience and availability significantly affected consumption amounts. Wansink (2007) provided further support for the statement that convenience and availability significantly effects consumption amounts through an experiment with soldiers in a mess hall. Similarly, college students who eat at college cafeterias are at a high risk of portion distortion (perceiving large portion sizes as appropriate amounts to eat at a single eating occasion). One study examined college students' (N=42) ability to accurately estimate cereal serving size relative to the USDA standard. In this study, only one-third of the students were within 10% of the standard serving size while the rest of the student's estimations were more than half of the stated portion sizes recommended on the labels (Bryant & Dundes, 2005).

Not only are college students unaware of serving sizes in a cafeteria setting, they have constant unlimited access to the amount of servings they receive; a second, third or fourth is always available to them. A student in a cafeteria setting is at high risk for increased caloric intake, simply because of the quantity of food available (Bryant & Dundes, 2005). The offering of an unrestricted supply of food is definitely a reason for overconsumption. The phenomenon of portion distortion has the ability to hinder weight loss, weight maintenance, and overall health improvements which continues to have an effect on our country.

College students' decisions about what to eat are currently made in an environment where no food labeling is required. College dining halls have foods environments that are characterized by foods high in energy, fats, added sugars, and low in nutrient density. Kolodinsky et al. (2007) used an intervention-based study to identify how closely respondents followed the *Dietary Guidelines for Americans 2005*, and whether their eating patterns were related to their knowledge of dietary guidance. Their finding suggest that increased knowledge of dietary guidelines appears to be positively related to more healthful eating patterns.

Nutrition Among College Commuters. There has not been extensive scientific research done on the dietary and physical activity habits among college commuters. However, an analysis performed by Oh et al (2001) was conducted to identify health-promoting behaviors and related factors by type of residence between two groups of college students: those who live in dormitories and those who commute from home. Their research found that dormitory residents presented significantly lower health-promoting practice scores than commuters in both gender. Multiple regression analysis showed that the factors associated with health-promoting behaviors were health environment ($p < 0.05$) and parental influence/support ($p < 0.01$) for male dormitory

residents. For female dormitory resident's interest in health($p < 0.05$), stress($p < 0.05$), and parental influence/support($p < 0.01$) were associated.

Another study done by Bae et al (2007) focused on the quality of meal and dietary habits of college students according to where they reside. The subjects were divided into three groups: first group was composed of students who reside in boarding-houses (BH group, N=72), second was students who reside in self-boarding set up (SB group, N=90), and third was those who lived in the same house with their parents (HWP group, N=98). Boarding houses are similar to a dorm setting; 2-4 students in a shared space with limited access to kitchen appliances outside of the school cafeteria. Self-boarding housing reflects a similar set up of apartment style housing, with a wide range of kitchen appliances. The BH group had significantly greater frequency of skipping breakfast and smoking than those of the SB and HWP groups. The amount of energy, food, carbohydrates, proteins, fats, vitamins and minerals consumed in the BH group were significantly higher than in the SB and HWP groups. Similarly, the NAR (nutrient adequacy ratio), MAR (mean adequacy ratio), ND (nutrient density) and INQ (index of nutritional quality) of the BH group were significantly greater than those in the SB and HWP groups. From the data obtained, the SB and HWP students appeared to have more dietary problems than the BH students. They concluded that students who reside in the self-boarding set up and who also live at home with their parents need to learn proper dietary management.

These studies are significant because it shows the importance of assessing the dietary composition and physical activity habits between commuters and residents on a college campus. It is clear that health-promotion behaviors vary among college students depending on type of residence. Further research is necessary in this area to understand what factors attribute to these health-promoting behaviors among various college students and their residence.

Nutrition Measurements. The USDA Center for Nutrition Policy and Promotion (CNPP) was established in 1994 to improve the nutrition and well-being of Americans. One of CNPP's core projects is a resource called MyPlate. MyPlate was introduced in 2011 along with the update of the USDA food patterns for the *2010 Dietary Guidelines for Americans*. MyPlate illustrates the five food groups that are the building blocks for a healthy diet using a familiar image - a place setting for a meal. The different shape, as compared to the Food Guide Pyramid and MyPyramid, is intended to help grab consumers attention with a new and improved visual cue. With this image they are trying to get people to think about what goes onto their plate, cup or bowl before eating by focusing on variety, amount and nutrition.

This study conducted a dietary recall through MyPlate via a system called SuperTracker. SuperTracker allows anyone to create a group and invite others to join. As the leader of the study, I ran reports of food and physical activity data of group members who shared their results with me. These reports included a dietary recall of 2 weekdays and 1 weekend day.

Physical Activity on Health. Physical activity has been proven to provide many physiological and psychological benefits. Regular physical activity can improve health and quality of life regardless of the presences of a chronic disease or disability (US Department of Health and Human Services, 2008). People who are physically active tend to live longer and have lower risk for heart disease, stroke, type 2 diabetes, depression and some cancers. According to the *2008 Physical Activity Guidelines for Americans*, adults need at least 150 minutes a week of moderate-intensity activity to obtain substantial health benefits and 300 minutes per week (defined as highly active) to obtain more extensive health benefits. The many benefits of participation in regular moderate- or vigorous-intensity physical activity are well established, yet more than 60% of the population is sedentary or insufficiently active.

The physical and social environments that most Americans sit or move within the context of their daily lives has been rapidly changing. The changes in technology and transportation has been associated with the significantly reduced demands for physical activity. Humans spend majority of their time in participating in sedentary behaviors - watching TV, computer use, electronic games, sitting in cars - which involve prolonged periods of low levels of metabolic energy expenditure. These specific sedentary behaviors may influence obesity and other metabolic precursors of major chronic diseases i.e., type 2 diabetes and cardiovascular disease.

Physical Activity Among College Students. Researchers reported that about 40% to 50% of college students are physically inactive. More important, health and physical activity professionals in higher education have not been able to effectively increase students' physical activity behaviors. College and universities are potentially important settings for reducing the prevalence of overweight and obesity in the adult population through the promotion of healthy weight management practices. More than 12 million students currently are enrolled in the nation's 3600 colleges and universities. One in 4 persons aged 18 to 24 years in the United States currently is either a full- or part-time college student, and half of all persons aged 20 to 24 years have attended college. Although overweight and obesity are an accumulation of factors from childhood into adulthood, overweight during the late adolescence is most strongly associated with increased risk of overweight in adulthood (Guo et al., 1994). Colleges and universities have the ability to provide numerous opportunities to positively influence students' physical activity, nutrition and weight management behaviors to a large population of older adolescence in an educational setting.

According to Lowry et al (2000), there have been many intervention studies that have documented the extent to which subjects adhere to prescribed dietary and physical activity

regimens during weight loss programs, a few population-based observational studies have examined the extent to which persons who are trying to control their weight include fruits and vegetables and limit high-fat foods in their diets, and the extent to which they engage in specific types of physical activity. Their research included the 1995 National College Health Risk Behavior Survey (NCHRBS), part of the Youth Risk Behavior Surveillance System (YRBSS) implemented by the Centers for Disease Control and Prevention (CDC), which assessed a broad range of priority health risk behaviors among a nationally representative sample of undergraduate college students attending 2- and 4-year institutions. The data showed that based on self-reported height and weight, 35% of students were overweight or obese (body mass index > 25.0) and nearly half (46%) of all students reported they were trying to lose weight. Most of the nation's college students are putting their health at risk through poor lifestyle choices that include insufficient physical activity and unhealthy food choices. This is an important target population that needs serious attention so this epidemic does not continue.

Physical Activity Measurements. This study adapted the Health Risk Behavior Survey along with the International Physical Activity Questionnaire (IPAQ) and the Stanford 7-Day Physical Activity Recall to assess physical activity in college resident and commuter students. Craig et al. (2003) conducted a study that reported the reliability and validity of the IPAQ instruments. Overall, the IPAQ questionnaires produced repeatable data (Spearman coefficient clustered around 0.8). The short IPAQ form "last 7-day recall" is recommended for national monitoring and the long form for more research requiring more detailed assessment. This study developed a questionnaire that contains content from both the short and long form of the IPAQ.

The Stanford 7-Day Recall (7-DR) is a well-known instrument for surveying work and leisure-time physical activity and to assess the habitual physical activity in men and women. The

7-DR assess all levels of physical activity from light to very hard. Richardson et al (2001) conducted a study to provide a comprehensive evaluation of the ability of this instrument to assess levels of habitual physical activity in men and women. According to the data, the ability of the 7-DR to assess habitual physical activity was greater for more vigorous than lower intensity physical activity.

The Youth Risk Behavior Surveillance System (YBRSS) was developed in 1989 by the CDC. The YBRSS monitors six types of health-risk behaviors that contribute to the leading causes of death and disability among youth and adults. This includes: behaviors that contribute to unintentional injuries and violence, sexual behaviors related to unintended pregnancy and sexually transmitted diseases, HIV infection, alcohol and other drug use, tobacco use, unhealthy dietary behaviors and inadequate physical activity. YBRSS also measures the prevalence of obesity and other priority health-related behaviors. The questionnaires that will be used in this study will include a number of questions adapted from YBRSS to focus on unhealthy dietary behaviors and inadequate physical activity as well as the prevalence of obesity by self-reporting height and weight.

Methods

Participants

The participants in this study were 38 college students that were 18 years or older. The college students were either a commuter or a resident of Merrimack College in North Andover, MA. Student athletes were able to participate in the study but they were not the target population as too many student athletes could affect the results. Participants for the study were found by

convenience (non-probability) sampling, through advertisement and word-of-mouth promotion on Merrimack College's campus.

Study Design

The projects study design was a combination of mixed methods: qualitative and quantitative measures. Qualitative measurements were used to look for patterns in non-numerical data i.e., resident or commuter students, living with parents, age, and class year. Quantitative measurements were used on data received with numerical values i.e., BMI, percent of nutrients in dietary composition etc.

A cross-sectional study design was used. The needs assessment and dietary recall was based off of an observational study that analyzed data collected from a population, college residents and commuters, at a specific point in time.

Measures

A physical activity assessment was developed to correspond to the Stanford 7-Day Recall and IPAQ. Changes in these tools were made to specifically assess the physical activity environment at Merrimack College as well as the physical activity habits among college students regarding their living situation. Examples of some of these questions being asked are:

1. During the last **7 days**, on how many days did your work involve **vigorous**-intensity activity that cause a large increase in breathing or hearth rate, for at least 10 minutes continuously? *Ex. Carrying or lifting heavy loads, construction work, diggings, or climbing up stairs.*
_____ days per week

2. How much time do you usual spend doing **vigorous** physical activity while at work?

_____ hours per day

_____ minutes per day

A dietary composition assessment was developed utilizing Myplate. Myplate is a premier food and nutritional service that was created as a food guide to keep track of and create a well-balanced meal plan. This dietary composition assessment required a nutrition recall that included 2 full weekday food logs and 1 weekend day food log. The principal investigator created the MyPlate profile for each participant and provided them with a participant ID, so information remains anonymous throughout the study. The food logs were comprised of detailed meals that the participant ate on specific days. An example of the SuperTracker system through Myplate is presented below.

The screenshot displays the MyPlate SuperTracker interface for Thursday, 03/15/18. It includes sections for Physical Activity Target (AT LEAST 150 minutes per week), Daily Calorie Limit (2600), and Daily Food Group Targets (Grains, Vegetables, Fruits, Dairy, Protein Foods). The Food Tracker section shows a search bar and a meal list with 0 calories for Breakfast, Lunch, Dinner, and Snacks. A graph shows 0% of target for food groups, and a Daily Limits section shows 0 calories eaten and 0g of added sugars, saturated fat, and sodium.

Week of	Target	Actual
03/11/18 to 03/17/18	AT LEAST 150 minutes per week	0 minutes

Allowance	Eaten	Remaining
2600	0	2600

	Grains	Vegetables	Fruits	Dairy	Protein Foods
Target	9 oz.	3½ cup(s)	2 cup(s)	3 cup(s)	6½ oz.
Eaten	0 oz.	0 cup(s)	0 cup(s)	0 cup(s)	0 oz.
Status	-	-	-	-	-

Food Tracker

Search: All Foods for Type in your food here

Meals

- Breakfast: 0 Calories (EMPTY)
- Lunch: 0 Calories (EMPTY)
- Dinner: 0 Calories (EMPTY)
- Snacks: 0 Calories (EMPTY)

Daily Limits

Total Calories Eaten: 0

Added Sugars: Eaten: 0g, Limit: 65g

Saturated Fat: Eaten: 0g, Limit: 29g

Sodium: Eaten: 0mg, Limit: 2300mg

The Youth Risk Behavior Surveillance System (YBRSS) is meant to measure the prevalence of obesity and other priority health-related behaviors. The questionnaires that were used in this study included a number of questions adapted from YBRSS to focus on unhealthy dietary behaviors and inadequate physical activity as well as the prevalence of obesity by self-reporting height and weight. Body Mass Index (BMI) was a self-reported measure that was included on the physical activity and dietary composition recalls. Participants were asked for their height and weight through this questionnaire and BMI was calculated as part of the data analysis. Examples of some of these questions being asked in the nutrition questionnaire are:

1. What kind of kitchen appliances do you have access to and use in your living environment? Please check all that apply:

Microwave

Toaster Oven

Toaster

Oven/Stove

None

Others, please specify: _____

2. How often do you eat at Merrimack's Dining Hall (Sparky's)?

_____ times a day

_____ days a week

3. How often do you purchase food or beverages from food places on campus other than Sparky's? *Ex. Zime, Warrior's Den, Dunkin Donuts, Starbucks, Stir-fry etc.*

_____times a day

_____days a week

Results

Demographic Information

The online survey was sent to 120 participants and 38 Merrimack College students completed the study, for a participation rate of 32%. The participant pool was comprised of 27 residents (71.1%) and 11 commuters (28.9%). There were 22 females (57.9%) and 16 males (42.1%). The average age of participants was 19 ± 1.65 years.

Table 1

Demographic Characteristics

	Frequency (N)	Percentage
Age		
18-20	27	19.5
21-25	11	6.51
Gender		
Female	57.9	42.1
Male	16	42.1
Ethnicity		
White	30	21.7

Hispanic	5	3.6
Latino	2	1.4
Black	1	0.7
Asian	0	0

Statistical Analysis

The participants were from each class level at Merrimack: Freshman (n= 15), Sophomore (n=8), Junior (n=8), Senior (n=7). The mean BMI of the groups was 26.71 ± 4.94 . There were no significant differences in weight, height, and BMI among the groups.

Table 2

Descriptive Characteristics

	Frequency (N)	Percentage
Class		
Freshman	15	39.5
Sophomore	8	21.1
Junior	8	21.1
Senior	7	18.4
Residency		
Residents	27	71.1
Commuters	11	28.9
Living Situation		

On Campus Dorm	23	60.5
On Campus Apartment	5	13.2
Off Campus Apartment	4	10.5
Live at Home	6	15.8
Employment		
Part-time	16	42.1
Full-time	3	7.9
Internship/Fellowship	3	7.9
Unemployed	15	42.1
BMI		
Thin	0	0
Normal	18	46.9
Overweight	11	29.1
Class I Obese	5	13.1
Class II Obese	4	10.4

The students on campus were asked general questions regarding their living situation in relationship to the meals that they ate and how they were able to prepare them. Descriptive statistic tests were run to find out the frequencies of the data from the nutrition and physical activity questionnaires.

Table 3

How Many Times Per Week Do You Eat at the Following Places?

	0-5	6-10	11-15	16+
Residents				
Sparky's	28.6	17.8	46.4	0.7
Non-Sparky's	71.4	21.4	0.7	0
At Home Meals	67.8	17.8	14.3	0
Commuters				
Sparky's	100	0	0	0
Non-Sparky's	60	30	0	10
At Home Meals	20	20	50	10

The table above represents the percentages of students who eat at Sparky's, Non-Sparkys (other food places on campus), and at home meals per week. A one-way ANOVA analysis showed that there was significant statistical difference among students with different living situations and the amount of times they cook meals at home, $(1,36) = 7.770$, $p = 0.008$. There also was significant statistical difference between students with different living situations and the amount of times they ate at the school cafeteria per week, $(1,36) = 15.445$, $p < 0.001$. There was no statistical significance between students with different living situations and the amount of times they ate at other food places on campus, $(1, 36) = 0.027$ $p = 0.870$. There also was no statistical significance between students with different living situations and the amount of times they cook meals at home and bring them to campus $(1, 9) = 0.237$, $p = 0.638$.

Table 4

Money Spent on Takeout Per Week

	\$0-\$25	\$25-\$50	\$50-\$75
Resident	44.4	44.4	11.1
Commuter	63.6	27.3	9.1

The table above represents the number of residents and commuters that spend money on takeout per week. A one-way ANOVA analysis showed that there is no statistical difference among people with different living situations on money spent on take-out per week, $(3,34) = 2.029$, $p = 0.128$. There was also no statistical difference among residents and commuters with number the times that they ordered take out per week, $(3,33) = 0.641$, $p = 0.594$.

Table 5

Types of Appliances by Residence

	Microwave	Multiple	None
Resident			
On Campus Dorm	73.9	26.1	0
On Campus Apt	0	100	0
Commuter			
Off Campus Apt	0	100	0
Live at Home	0	100	0

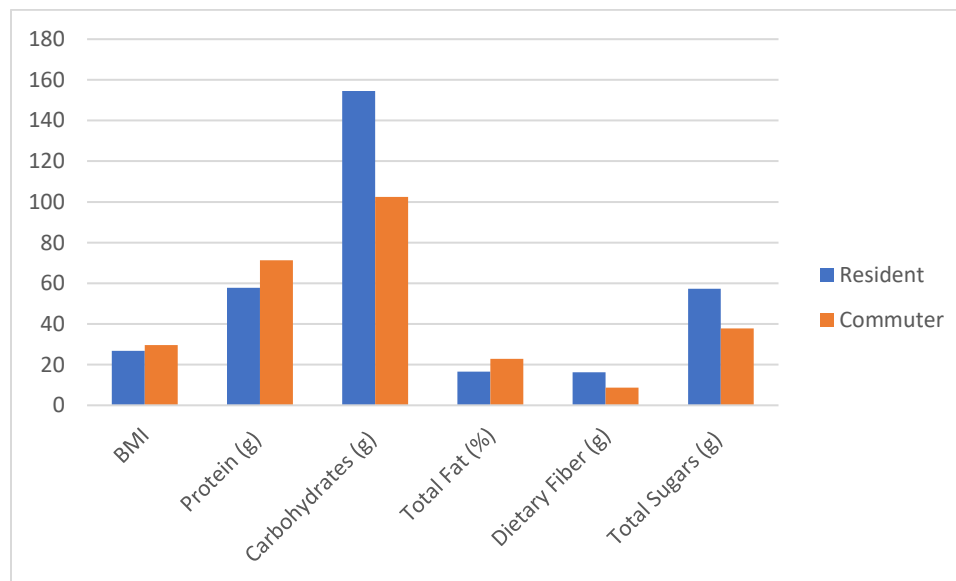
The table above shows the percent of students that have just a microwave versus multiple appliances available to them. This includes all four categories of residency that were included in the study. Multiple appliances represent having a microwave plus other additional kitchen

appliance (fridge, stove, oven, toaster, and toaster oven). A one-way ANOVA analysis showed that there was statistical difference among residents and commuters access to kitchen appliances with regards to living situation, $(3,34) = 9.177, p < 0.001$.

Dietary Food Log Analysis

All students were asked to complete a 3-day dietary food log. The food logs were submitted electronically through SuperTracker via Myplate. Of the 38 students, 16 of them completed the food logs completely to analyze statistically. The analysis of the dietary food logs included comparison of student's intake of protein, carbohydrates, total fat, total sugars, dietary fiber, and total calories. Their BMI was also recorded and compared as well. The data from the food log entries were entered into excel to calculate means and standard deviations of all groups.

Figure 1: Average BMI and Consumption of Macronutrients Between Residents and Commuters



An independent t-test was conducted to compare BMI and the consumption of protein, carbohydrates, total fat, total sugars, dietary fiber, and total calories between residents and commuters. There was no significant difference in the scores for BMI for residents ($M=26.81$,

SD=5.11) and commuters (M=29.64, SD=7.38); $t(12) = -0.824, p = 0.421$. There was no statistical difference in the scores for protein (g) for residents (M=57.71, SD=7.28) and commuters (M=71.29, SD=70.17); $t(12) = -0.473, p = 0.644$. There was no statistical difference in the scores for carbohydrates (g) for residents (M=154.57, SD=68.62) and commuters (M=102.42, SD=68.63); $t(12) = 1.466, p = 0.168$. There was no statistical difference in the scores for total fat (%) between residents (M=16.57, SD=13.21) and commuters (M=22.86, SD=12.54); $t(12) = -0.913, p = 0.379$. There was no statistical difference in the scores for dietary fiber (g) between residents (M=16.29, SD=11.04) and commuters (M=8.81, SD=5.76); $t(12) = 1.608, p = 0.134$. There was no statistical difference in the scores for total sugars (g) between residents (M=57.29, SD=27.92) and commuters (M=37.86, SD=34.20); $t(12) = 1.164, p = 0.267$. There was no statistical difference in the scores for total calories between residents (M=1327.71, SD=541.39) and commuters (M=1336, SD=1087.73); $t(12) = -0.018, p = 0.986$. These results suggest there is no statistical difference in BMI, protein, carbohydrates, total fats, total sugars, and total calories between residents and commuters.

When looking at the means between the two groups there was no clear statistical differences between the two groups. The two means and standard deviations that raised some awareness were total carbohydrates between residents (M=154.57, SD=68.62) and commuters (M=102.42, SD=68.63) as well as total sugars between residents (M=57.29, SD=27.92) and commuters (M=37.86, SD=34.20).

Discussion

Overview and Major Findings

The current study explored the quality of nutrition and accessibility to kitchen appliances between commuters and residents at Merrimack College. Through the use of questionnaires and dietary food logs, the study was able to determine the effects of college residency and access to kitchen appliances on the dietary health of college students.

The major findings were that there was statistical difference among students with different living situations and the amount of times they cook meals at home, as well as the amount of times that they ate at the school cafeteria per week. When comparing how much money students spent on takeout, residents spent more money and ordered takeout more frequently than commuters. The most interesting findings from the dietary food logs was the difference between the means of the consumption of total carbohydrates and total sugars between residents and commuters. This suggests that students who live on campus and eat at the dining hall more often have more access to carbohydrates and sugars. This could be due to the fact that these foods are more accessible and always present in the dining hall so these students who eat there are going to be more likely to consume them versus the students who live in an on-campus apartment or at home.

These results suggest that students who eat frequently at the campus dining hall have easier access to types of foods that are high in carbohydrates and sugars. Consistent with the hypothesis, the current study found that residents were subject to portion distortion and unhealthier eating habits compared to commuter students who have easier access to kitchen appliances and home cooked meals. Although healthy options are available around campus and at the dining hall, there are also various unhealthy options that are much easier for residents to access.

Correlation Between Study Findings and Literature

The findings from this study correlate to Wansink & Van Ittersum (2007) who demonstrated that convenience and availability significantly affected consumption amounts. Although the previous studies indicated that there was a high risk for increased caloric intake in a cafeteria setting, the current study found that there was no significant difference between residents and commuters who ate at the dining hall. This could be contributed to the low number of participants on the dietary food log portion of this study. Bae et al (2007) concluded that students who reside in self-boarding housing and who also live with their parents need to learn proper dietary management. The results from this study correlate to Bae's study but are not significant enough to conclude that residents on campus and those who live at home need to learn proper nutrition.

Strengths and Limitations of the Study

The primary limitation of the study was the relatively low sample size (N=38). The small sample size was largely due to the length of time allowed for the study as well as a significantly high dropout rate. Due to this study being a requirement for an accelerated master's program, upon receiving IRB approval the researcher only had approximately three months to recruit participants, obtain informed consent, collect data from the participants, and analyze the data collected. Due to this short timeline, the recruitment of new participants was stopped mid-March to ensure enough time for data analysis. In addition to the small sample size, there was a small ratio of commuters to residents (11:27). If a larger number of commuter residents participated in the study, it would have allowed for a better representation of the commuter population at Merrimack College.

Another limitation of the study was the high number of student athletes at Merrimack College. Due to this, there were more student athletes who participated in the study. This could

have impacted the data collected from the nutrition and physical activity questionnaire and dietary food logs because most student athletes have a greater knowledge of nutrition and higher physical activity levels compared to the average college student.

An additional limitation of the study was that not all participants completed the dietary food logs which contributed to missing data. The participants may not have completed the food logs due to time and/or complication of creating an account and providing the researcher access to the completed food logs. Due to this limitation, it was difficult to make proper and accurate correlations between dietary intake and residency on campus.

A further limitation of the study was that there was no physical activity score to be compared between residents and commuters. The principal investigator felt that the results received were too vague to complete statistical analyses. Future studies would want to look further into the physical activity portion of this study to expand upon physical activity levels between residents and commuters.

Future Directions

Future studies should look to expand upon the significant findings that were discovered in the study. In order to do so, future studies that analyze the quality of meal and dietary habits of college students should look to increase the number of participants as well as a better ratio of commuter and resident students. An ideal study would be able to recruit the entire student population of a college campus to participate or a sample population from various colleges. In order to do so successfully, future studies should have an adequate time frame of the study (minimum of two years) in which to recruit participants and to include a more diverse sample size.

Future studies should also consider looking at dietary habits of these students over the course of 4 year (freshman to senior year). If this was not possible, having a significant number of students from each year to compare would be a promising study. This longer time period would allow for more meaningful data to be collected from participants. In addition, future studies should expand upon the current nutrition and physical activity questionnaires that were provided to participants to be able to incorporate more areas of interest into the current topic. For example, the study could look at stress, alcohol, and sleep as factors of nutrition and physical activity.

Practical Applications and Implications

The findings of the present study shed light on the topic of obesity and portion distortion on college campuses. Weight gain in college can be contributed to unhealthy eating habits, stress, and lack of exercise. According to the Centers for Disease Control and Prevention, about 5.2 million college students are obese. This study researched contributors to obesity on college campuses. The results from this study are the beginning of a possible future study that could dig deeper into the epidemic of obesity. If this study were developed further, it could begin expand to other colleges and universities to collect more data on the contributors of weight gain and obesity in college. After this occurs, colleges and universities will have all of the data to pinpoint their weaknesses on campus and what direction they could go in to make them strengths.

Merrimack College could use this current to study to adapt new programs throughout the college to engage students to learn more about nutrition and physical activity. This study could also be used by Merrimack to target specific students who are subjected to portion distortion on their campus. They could do this by limiting the number of servings of carbohydrates and sugars that are found throughout the dining hall. A study like this is a great way for Merrimack College

to better understand their students' dietary habits and what can be done make healthy eating easier and more accessible for all students on campus.

Conclusion

In summary, the most important finding of the current study is that residency and access to kitchen appliances in college does contribute to the overall health of college students, through the increased intake of carbohydrates and sugars (over residents and over the recommended servings per day). The environment that colleges and universities create are not always conducive to proper nutrition and physical activity. Most college students do not have access to their own kitchen appliances, therefore they are eating for convenience instead of nutrition. The options that are offered in dining halls are limited and students are often subjected to portion distortion. It is important to assess this age demographic and this specific environment in order to intervene appropriately. With an appropriate timeline and population size, this study could be further developed to explore other contributors to unhealthy habits in college. If college campuses don't begin to intervene and create programs for their students, they will continue to advance the obesity epidemic that we are facing and college students will be more likely to go on and experience overweight or obesity in adulthood.

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Appendix A**MERRIMACK COLLEGE****INFORMED CONSENT**

CONSENT TO PARTICIPATE IN RESEARCH PROJECT ENTITLED: *Nutrition and Physical Activity Recall to Assess the Health Status of Commuters and Residents on a College Campus*

Principal Investigator(s): _____ Holly Scott _____

Participant's Name: _____

You are invited to take part in a research study examining the assessment of dietary composition and physical activity habits of students at Merrimack College. You have been asked to be in this study because we are particularly interested in this link among college residents and commuters.

Procedures: If you choose to participate in the study, you will be asked to complete two questionnaires. The first survey contains questions about one's physical activity. The second questionnaire asks about the participant to complete a nutrition recall through MyPlate which will consist of 3 days of food logs; 2 weekdays and 1 weekend day. Both surveys will take approximately 15-20 minutes to complete.

Benefits: This study may be of no direct benefit to you, but the questionnaires may help you to be more aware of your nutrition and physical activity habits. Some individuals have found that this increased insight has improved habits in their health and wellness.

Potential Risks: There are no inherent physical risks in the procedures themselves, and it is not anticipated that participants will experience risks in completing the questionnaire. Participants will not be exposed to any more risk of harm or discomfort than those ordinarily encountered in daily life. Occasionally, an individual may be more aware of ongoing nutrition or physical activity habits as a result of completing the questionnaire. If this is the case, you are free to discontinue completing the surveys at any time. In addition, information about supportive dietary and physical activity services available on campus will be made available should you be interested.

Confidentiality: The information from the surveys will be used for research purposes only. Your responses will be identified by a number and the identity any participant will be kept confidential. In addition, your name will not be used in any reports or publications of this study.

Freedom of Choice to Participate: You are free (1) to decide whether or not to participate, and also free (2) to withdraw from the study at any time. A decision not to participate will not

adversely affect any interactions with the investigator or any representative/employee of Merrimack College.

Questions: Before you sign this form, please ask any questions on any part of this study that is unclear to you. You may take as much time as necessary to think this over. At any point in the study, you may question the Principal Investigator, Holly Scott, about the study (scotth@merrimack.edu). In addition, you are free to contact the Institutional Review Board Chair, with any questions (irb@merrimack.edu).

Consent: This project has been explained to me to my satisfaction and in language I can understand, and I have received a copy of this consent form. I understand what my participation will involve and I agree to take part in this project under the terms of this agreement. I understand that I am not giving up my legal rights by signing this form.

Signature of Participant

Date

Printed Name of Participant

Signature of Investigator Obtaining Informed Consent

Date

Appendix B

Physical Activity Questionnaire

The purpose of this questionnaire is for me to gain an understanding of the amount of time you spend doing different types of physical activity during the week. The purpose of these questions is to obtain comparable data of health-related physical activity. This questionnaire should take no more than 20 minutes to complete.

Participant ID: _____

Part 1: General Questions

1. What is your age?

_____ years

2. To which gender do you most identify?

Female

Male

Other: _____

Prefer not to answer

3. What is your ethnicity?

White

Hispanic

African American

Asian

Other

4. What class are you in at Merrimack College?

Freshman Sophomore Junior Senior

5. What is your height?

____feet ____inches

6. What is your weight?

_____lbs.

7. Have you ever used the fitness center at Merrimack College?

Yes

No

8. If yes, how many days a week do you use the fitness center?

_____ days per week

9. If yes, have you ever attended a fitness class held at the fitness center?

Yes

No

10. Do you have a gym membership at any franchise location? Please list all gym memberships: *Ex. Planet Fitness, Golds' Gym, LA Fitness, YMCA, etc.*

11. How many days a week do you use your gym membership?
_____ days per week

Part 2: Work Related Physical Activity

The section is about your work. This includes paid jobs, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family.

12. What is your current employment status?

Part-time

Full-time

Internship, Fellowship, or CO-OP

Unemployed (if unemployed please go to the next section)

13. During the last **7 days**, on how many days did your work involve **vigorous**-intensity activity that cause a large increase in breathing or hearth rate, for at least 10 minutes

continuously? *Ex. Carrying or lifting heavy loads, construction work, diggings, or climbing up stairs.*

_____ days per week

14. How much time do you usual spend doing **vigorous** physical activity while at work?

_____ hours per day

_____ minutes per day

15. During the last **7 days**, on how many days did you do **moderate** physical activities like carrying light loads as part of your work? Please do not include walking.

_____ days per week

16. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ minutes per day

_____ minutes per day

17. During the last **7 days**, on how many days did you **walk** for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to or from work.

_____ days per week

18. How much time did you usually spend on one of those days **walking** as part of your work?

_____ hours per day

_____ minutes per day

Part 3: Transportation Physical Activity

These questions are about how you traveled from place to place, including to places like work, stores, movies, classes, and so on.

19. During the last **7 days**, on how many days did you travel in a motor vehicle like a train, bus, or car?

_____ days per week

20. How much time did you usually spend on one of those days traveling in a train, bus, car, or other kind of motor vehicle?

_____ hours per day

_____ minutes per day

21. During the last **7 days**, on how many days did you walk for at least 10 minutes at a time to go from place to place?

_____ days per week

22. How much time did you usually spend on one of those days walking from place to place?

_____ hours per day

_____ minutes per day

Part 4: Recreational Activities

This section is about all the physical activities that you did in the last **7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

23. Are you a student athlete at Merrimack College?

Yes

No

24. If yes, please specify what sport(s) you participate in.

25. During the last **7 days**, on how many days did you do vigorous physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time?

_____ days per week

26. How much time did you usually spend on one of those days doing vigorous physical activities in your leisure time?

_____ hours per day

_____ minutes per day

Part 5: Time Spent Sitting

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

27. During the last **7 days**, how much time did you usually spend sitting on a **weekday**?

_____ hours per day

_____ minutes per day

28. During the last **7 days**, how much time did you usually spend sitting on a **weekend** day?

_____ hours per day

_____ minutes per day

YOU HAVE NOW COMPLETED THE PHYSICAL ACTIVITY QUESTIONNAIRE,

THANK YOU FOR PARTICIPATING!

Appendix C

Nutrition Questionnaire

The purpose of this questionnaire is for me to gain an understanding of some of your nutrition habits in relation to your living situation and access to kitchen appliances. The purpose of these questions is to obtain comparable data of health-related nutrition. This questionnaire should take no more than 10 minutes to complete.

Participant ID: _____

1. Are you a resident or commuter?

Resident

Commuter

2. Please answer what best describes your living situation:

On campus dorm

On campus apartment

Off campus apartment

Live at home

3. What kind of kitchen appliances do you have access to and use in your living environment? Please check all that apply:

Microwave

Toaster Oven

Toaster

Oven/Stove

None

Others, please specify: _____

4. How often do you eat at Merrimack's Dining Hall (Sparky's)?

_____times a day

_____days a week

5. How often do you purchase food or beverages from food places on campus other than Sparky's? *Ex. Zime, Warrior's Den, Dunkin Donuts, Starbucks, Stir-fry etc.*

_____times a day

_____days a week

6. If you are a commuter, how often do you prepare meals at home and bring them to campus with you?

_____times a day

_____days a week

7. How often do you purchase food from off-campus food establishments? *Ex. Chipotle, Panera, Chinese, B-good, Casa Blanca, Domino's or other Pizza Establishments, Fast food chains, Dunkin', Perfectos, etc.*

_____days a week

_____times a day

8. On average, how much money do you typically spend in a week on food and beverage purchases? *Ex. All examples included above. Please include coffee purchases.*

\$0 - \$25

\$25 - \$50

\$50 - \$75

\$75 - \$100

More than \$100

9. How often do you prepare your own meals (breakfast, lunch, dinner, and snacks) using your own kitchen appliances?

_____times a day

_____days a week

**YOU HAVE NOW COMPLETED THE NUTRITION QUESTIONNAIRE, THANK YOU
FOR PARTICIPATING!**