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A Question of Food Intake: The Impact of Living Arrangement and Meal Factors on Total Daily Caloric Intake

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Abstract

There has been dramatic weight gain among college students during their collegiate years. A food diary can give much insight of a college student's life. The purpose of this study is to analyze the food intake of college-aged students taking in factors such as the size of meal, the foods being eaten, the location of the meal, and if the meal was eaten with others. This research will examine how the student's food intake throughout the day may affect their overall food calorie intake.

The transition to college from high school comes with a lot of changes and one of them being food intake. Many students struggle with food choices during this time of transition. Sometimes as a solution to these struggles, a food diary is a recommended tool that can be used to help track food choices and make students more aware of where their diets could be improved or to identify patterns in their consumption behaviors. For example, it provides insight as to why one is eating when not hungry, how others can affect eating habits, how much is actually being eaten, how fast food is eaten, how one feels after eating certain foods, and be able to match food consumption perceptions with reality. There are specific guidelines for daily caloric intake for those ages 19-30, the typical college student age (U.S. Department of Health Services, 2015). These are shown in Appendix A.

The factors of stress, family background, and environment can also affect the way one eats and their eating patterns. While all of these have influence on eating patterns, the ones focused on in this study will be living arrangements, meal factors, and effects of snacking. The living arrangement determines if the students are on a meal plan, a sorority/fraternity meal plan, or if the student is making their own meals. The meal factors include meal size and amount of meals throughout the day which gives insight on whether the student was rushing, taking their time, or even predicting the food intake for the entire day. The sections below examine the prior research in these areas.

Location of Meal

There have been a multitude of studies done on the effects that living arrangements and social behaviors have on dietary and weight behaviors. These lifestyle factors include nutrient content, food choices, alcohol consumption, dieting, and smoking (Beerman, 1991). In a study

done by Brunt (2008), students living off-campus were more likely to be overweight/obese than those living on-campus. The reasoning behind this has to do with food availability, preparation, cost, and the social aspect with eating. He concludes students in the residence halls with a meal plan are more likely to have a variety of food choices and therefore will be influenced to make healthier eating choices. He notes that those living off-campus ate less fruits and vegetables than students living on-campus and ate out at restaurants more frequently. Since students not on the meal plan consume less nutrient-dense foods, this indicates that the majority of their calories come from higher fat and sugar and non-nutrient dense foods, which includes alcohol (Brunt, 2008).

The students who eat on campus have more of a healthier variety in their diet. An important aspect of any diet is variety and this ensures that dietary recommendations are being met (U.S. Department of Health Services, 2015). The more nutrient-dense variation there is in a diet, the less overall calories that will be consumed leading to lower body fat (McCrory, 1999). As seen in the research, in an effort to control or lose weight, students who are gaining weight have the pattern of skipping meals (Debate, 2004). Brunt (2008) also provides the awareness that students living off campus may have a higher alcohol intake because of the restrictions within the dormitories and sorority/fraternity houses.

Although the study didn't show the exact quantity of foods being eaten, the students provided a tally for how many times they ate a certain food group over a three-day time period and the location of the meal. Of all of the students, almost all of them indicated eating two or more sweet/fat choices which shows that this food is common among college students on and off campus (Debate, 2004). The different locations of meals being eaten leads to the first hypothesis:

Hypothesis 1: Students eating on campus have an overall lower caloric intake than students eating off campus.

The other aspect with a living arrangement pertains to the social part of eating. In a study done by Tani (2015), dietary behaviors were examined in relation to eating alone, sometimes eating alone, or eating with others. Tani (2015) found that there is a higher chance that one is underweight, overweight, or shows unhealthy eating behaviors if they eat or live alone. Moreover, people living alone will have less of an opportunity to dine with others which can lead to obesity, unhealthy eating, and disordered eating (Fulkerson, 2014). The frequency of skipping meals is a lot higher with those exclusively eating alone (in this sense exclusively eating alone meant the participants indicated in their eating status response that they ate with 'no one'.) For males, skipping a meal occurs significantly more often with those exclusively eating alone and living alone. On the other hand, for females, skipping a meal occurs more often with those exclusively eating alone and living with others (Tani, 2015). Males that exclusively eat alone and live alone have a lower frequency of vegetable and fruit intake. Females that exclusively eat alone and live with others have the lowest frequency of vegetable and fruit intake (Tani, 2015). For obesity rates, there is a higher rate for males that exclusively live alone. For females, this rate is much higher when they eat with others and live alone or if they exclusively eat alone and live with others (Tani, 2015). For underweight rates, there is a higher rate of males who are underweight that eat with others and live alone. Evidence shows that it was more prominent for men who ate alone and lived alone to skip meals. It was also more common for women who ate alone and lived with others to skip meals. The evidence leads to this hypothesis:

Hypothesis 2: Students eating alone will have a lower caloric intake than those students eating with others.

Meal Factors

The meal factors are broken into two different parts: the actual size of the meal (by calories) and the amount of meals throughout the day (including snacks). Meal size is determined by the total caloric intake during one meal sitting. In a study done by Shah (2011), results show that the increased caloric intake of a single meal in the middle of the day does not affect an average or obese person over time. Changes in meal size were directly correlated with meal frequency. It was typical for one to eat larger meals if they were eating less times per day (Collier, 1999). Another study examined the exposure to different meal portion sizes on total caloric intake. The average intake was 332 kcal/day higher in a large lunch rather than a smaller lunch (Jeffery, 2007). The subjects were able to choose between the larger or the smaller lunch. Those that chose to eat the larger lunch actually had higher total caloric intake throughout the entire day than those who chose the smaller one. The exposure to more food increases the likelihood that it will be eaten even if not hungry. Over time, this will lead to a body weight increase (Jeffrey, 2007). On smaller lunch days, the total caloric intake averaged 1875 kcal and on larger lunch days, the total caloric intake averaged 2153 kcal (Jeffrey, 2007). The exposure to larger portion sizes increases the likelihood of eating more calories as well as fat. The amount of fat eaten throughout the weeks was around 48% of calories from fat with the larger portion (Jeffrey, 2007). The overall caloric intake for the day was consistent with the lunch sizes regardless of outside factors such as where, when, and with whom the food was eaten.

In a study done with undergraduate students, larger portion size of food was associated with more calories consumed for that meal and resulted in weight gain (Fisher, 2003). Restaurants are serving larger serving sizes than in the past. According to The Journal of Nutrition, the growth of meal sizes in restaurants (specifically fast food) is estimated to be 2 to 5 times larger than two decades ago (Rolls, Ello-Martin, Ledikwe, 2005). Total meal caloric intake increased by 25% when a larger entrée portion was served (Diliberti, 2004). Also, the stomach is a muscle and it can be stretched just as any other muscle in the human body. Over time, when one eats an abundant amount of calories, the stomach has more space for food the next meals because of overconsumption (Gallo Institute of Health & Nutrition, 2013).

Hypothesis 3: Students will progressively eat more throughout the day; their last meal will be the largest caloric intake of them all.

Irregular meal frequency (or the number of meals) is another factor. Irregular meal frequency is correlated with a higher overall caloric intake. Subjects that did not have a routine for their meals and ate sporadically actually increased their overall caloric intake over the past decade (Farshchi, 2004). Individuals who ate at regular intervals concerning the amount of meals tended to be healthier and gained less weight overtime (Ekmekcioglu, 2011). A study done by Paul Arciero indicated that more frequent and consistent meals with a high protein content actually lowered the overall daily caloric intake (Arciero, 2013). Several studies found an inverse relationship with meal frequency and body weight (Drummond, 1998; Fabry, 1964). Another study indicated that as meal caloric intake increases throughout the day, the amount of time between meals actually decreases (Castro, 2007). This result indicates that people become

less satisfied at night, which can lead to overeating. In contrast, subjects who began their day with a large meal decreased the meal sizes throughout the day, leading to a lower overall daily caloric intake (Castro, 2007). The correlation between a meal caloric intake in the morning is negatively related to the overall caloric consumption. Ingesting a high proportion of the entire daily intake in the morning is associated with an overall lower daily intake. (Castro, 2007). This pattern was shown to be the same on weekdays as it was on weekends. This evidence leads to the hypothesis:

> *Hypothesis 4: Students that have a higher caloric intake for their first meal will have an overall lower caloric intake for the entire day as compared to students who have a smaller first meal.*

Snacking during the Day

The caloric intake of snacks increased when the package size increased. Subjects that ate natural foods or portioned their snacks ate significantly less during their snack times than those eating from a larger package (Rolls, 2004). According to Hartmann, women tend to snack more often than men (Hartmann, 2013). A study was done to investigate how snacking frequency had an effect on the overall caloric intake. The results were that obese subjects were found to be snacking more frequently and the snacks had a higher sugar and fat intake (Forslund, 2005). Those found to be snacking had an inconsistent meal schedule and the snacks that were eaten had a low nutrient level leading to eating more because of hunger. The difference in caloric intake between the most frequent and least frequent snackers was around 830 kcal per day. This overall caloric increase leads to a large weight gain over the course of a lifetime.

Hypothesis 5: Students who snacked more often, had a higher caloric intake of each snack than students who did not snack frequently.

STUDY

Participants and Method

Food diaries were collected from approximately 100 students in the MK386 (Health Care Marketing) class offered during the spring semesters of the last five academic years at Butler University. The food diary was an assignment in the class for which the class participants received a grade. Students in the class were asked to keep a food diary for two weeks in the middle of the semester, to accompany a discussion of marketing food and nutrition information that was taking place in class. In these food diaries, students were asked to record everything they ate and drank during that two-week period. The layout of the food diary is shown in Appendix B. Prior to sharing the food diary data with the student researcher in this Honors Thesis, the professor who collected and graded the assignments stripped out any identifying information for the student who submitted the food dairy. The only information about the student who submitted the food diary that is included in the data file being used for this Honors Thesis is the gender of the diary keeper and the semester in which he or she was enrolled.

There were a total of 84 participants who completed the food journals with an average of 45 items recorded for each one over the two-week time period. Of those participants, the majority of them were junior or senior students because the course was open to upperclassman. A total of 33 males and 51 females participated.

Results

To analyze the data captured in the food diaries, the independent variables of number of meals eaten per day, timing of first meal, number of snacks each day, day of the week, with whom the meal was eaten, physical location of where the meal was eaten, and gender were assigned categorical variables, which are shown in Appendix C. For each hypothesis, the dependent variable will be daily calorie intake. In most cases, t-tests were conducted to test the differences between groups.

Location of meal

In order to test H1, that students eating on campus have an overall lower caloric intake than students eating off campus, an ANOVA test was conducted between the groups. The results showed that students who ate at restaurants had an overall higher meal caloric intake than at home or at school. This was consistent with the research from the literature review. The statistically significant data ($t(1, 2361) = -24.65$, $p < .001$) showed that students that ate at a restaurant had an average caloric consumption of 829 calories per meal, where at home it was 426 per meal. There was also a significant difference ($t(1, 1080) = 12.92$, $p < .001$) for students that ate at school versus at a restaurant. The calories consumed at a restaurant were 829 calories per meal, while at school it was an average of 531 calories per meal. Therefore, H1 is not rejected.

The Impact of Eating Alone

In order to test H2, that students eating alone will have a lower caloric intake than those students eating with others., a t-test was conducted between groups. The results showed a significant difference ($t(1, 3469) = -22.98$, $p < .001$) such that students that ate alone had an

average caloric intake of 380 calories per meal, while students that were eating with others had an average caloric intake of 648 calories per meal. This affirms the second hypothesis assertion.

Type of meal

In order to test H3, that students will progressively eat more throughout the day with their last meal being the largest caloric intake of them all, an ANOVA test was conducted between the groups. The results showed ($t(1, 3478) = 261.79$, $p < .001$) that dinner had the highest number of calories; breakfast averaged 328 calories per meal, lunch averaged 600 calories per meal, and dinner averaged 688 calories per meal. The third hypothesis affirms these results.

The Impact of Eating Breakfast

In order to test H4, that students with a higher caloric intake for their first meal will have an overall lower caloric intake for the entire day as compared with students who have a smaller first meal, a t-test was conducted between the groups. The results showed ($t(1, 4016) = -5.18$, $p < .001$) that students who ate breakfast had an overall higher daily caloric intake. This finding leads to a rejection of H4. The data showed that participants that ate breakfast during the day consumed an average of 1719 calories per day, while those who did not eat breakfast consumed an average of 1519 calories per day.

Number of Snacks

In order to test H5, that students who snacked more often, had a higher caloric intake of each snack than students who did not snack frequently, an ANOVA was conducted between the groups. The results were statistically significant ($t(1, 1624) = 2.30$, $p < .001$) for one snack per day having a higher caloric intake than four snacks. The caloric intake for one snack was 491.12 calories while for four snacks it was 266.31 calories. The per snack calories for one snack is a lot higher than with more snacks; however, more calories were consumed overall for four snacks

a day versus for one snack. The fifth hypothesis that students who snack more often with have a higher caloric intake of each snack than those who did not snack frequently, is supported by these results.

Limitations

The most prominent limitation of this thesis is the participant's lack of recording an item in the food journal or the accidental miscounting of calories written. The lack of reporting could be due to participant forgetfulness, laziness, or possibly feelings of guilt because it was unhealthy food choice. The miscounting of calories is possible for participants since they are required to write down every calorie that is eaten. There is no way to be completely certain that all entries were documented to the correct amount.

Another factor that could potentially effect this research is the time frame of the study. The two-week food journal is a sufficient amount of time to understand the food patterns that students have, but a longer study would validate these hypotheses even more. The longer time could also indicate the participant's awareness of eating patterns and food entries may change in the next weeks.

Conclusion

There were several main findings for this research. These include having an overall lower daily caloric intake when having breakfast, having an overall lower meal caloric intake when eating at home/school or eating alone, having the last meal be the most calorically dense, and the total calories increase with the more snacks that are eaten. The main focus for this research was on meal factors and how they affected daily and meal caloric intake. There are

several other directions that the research can go in the future to connect with the focus of this research. Some possibilities are to include the caloric intake of the drinks, indicate the physical activity that was completed, provide the option for the participant to write their mood with each meal, and to make note of the amount of sleep that was had each night.

With the current data, the participant can indicate if there was a drink with the meal, but there was no indication how many calories were in each drink. This inclusion could create further exploration into the types of drinks and how those can affect overall daily caloric intake. It can also uncover if having sugary drinks lead to other unhealthy habits throughout the day, or even if beginning the day with healthy fruity drink/smoothie can curve cravings for the rest of the day.

Another opportunity to further the research could include writing in the physical activity along with caloric intake in the food journal. This would add another dimension of calories in versus calories out. The act of writing out or not writing out the workouts can lead to other healthier habits. If the food journal was collected over a longer period of time than 2 weeks, it would be interesting to ask participants to begin including their workouts half-way through the study. This could greatly impact the types of foods that are eaten because of how aware students are of being healthier with exercise. It will be easier to measure this if there is data collected first without mentioning the physical activity.

The last opportunity to explore would be having participants write out their mood for each meal. This would indicate whether the meal was eaten peacefully or possibly out of emotional eating. The research would open to see if participants who do a lot of emotional eating have a higher daily caloric intake than students who do not. Indicating the mood could

also be a way for the participant to be more aware of the way they're feeling along with the types of foods that are being eaten.

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APPENDICES

Appendix A:

Gender	Activity level	Calories consumed daily
Male	Sedentary	2,400-2,600
	Moderately Active	2,600-2,800
	Very Active	3,000
Female	Sedentary	1,800-2,000
	Moderately Active	2,000-2,200
	Very Active	2,400

Appendix B:

Week	Day	Meal	Food/Beverage Consumed	Calories	Alone?	Location

Appendix C:

	FACTOR	CATEGORICAL VARIABLE
Gender	Male	1
	Female	2
Year	2010	1
	2014	2
	2015	3
	2016	4
Week	Week 1	1
	Week 2	2
Day	Monday	1
	Tuesday	2
	Wednesday	3
	Thursday	4
	Friday	5
	Saturday	6
	Sunday	7
Meal	Breakfast	1
	Lunch	2
	Dinner	3
	Snack	4
Drink	No drink	0
	Water/Coconut Water	1
	Soda	2
	Diet Soda	3

	Tea/Sweet tea	4
	Coffee	5
	Milk/chocolate milk	6
	Juice/lemonade/Gatorade	7
	Alcohol	8
	Other	9
Food	No food item	0
	Food item	1
Breakfast	No breakfast	0
	Breakfast	1
Social company	Alone	1
	With others	2
Location	Home	1
	Restaurant	2
	Work	3
	Class/sorority/fraternity/dining hall	4
	Car	5
	Other	6