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The Impact of Breakfast Habits on Diet Quality and BMI in College Students

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Introduction

Breakfast is usually referred to as the most important meal of the day. However, about 25% of American adults do not consume breakfast regularly[1]. Skipping breakfast may result in overcompensating intake at lunch or dinner, resulting in a higher calorie intake throughout the entire day. Existing research compares how appetite, energy intake, nutrient intake, and hormones are similar and different between breakfast-eaters and breakfast-skippers. Breakfast's impact on calorie intake has a lot of mixed reviews in the literature. Some studies reveal that breakfast consumption leads to a higher daily calorie intake compared to breakfast-skippers[2]. Meanwhile, in other studies where participants consume an ad-libitum lunch, there is no calorie difference between the two groups[3]. There may be differences in nutrient intake due to variances in energy consumption. Breakfast-eaters consume more nutrients that are typically low in Americans in a day[4]. If breakfast-eaters are consuming more nutrients that people usually do not eat enough of, then breakfast can be thought of as the most important meal of the day.

There is variability in the results of current research, no one knows how to identify if breakfast really is the most important meal of the day. There are also no set factors on what constitutes breakfast as the most important meal of the day. College students are underrepresented in the research about breakfast habits. They are a unique group to look at since they tend to have odd timing for meals and are independent for the first time. This independence can have a big impact on diet quality. This study examines if breakfast habits in college students have an impact on dietary habits. The objective of this study is to compare nutrients, calorie intake, and BMI between those that eat breakfast and those that skip breakfast.

Methods

In this cross-sectional observational study, recruitment of participants happened via campus-wide email at the College of Saint Benedict and Saint John's University (CSB/SJU). To qualify for this study, participants had to be 18-23 years in age, be a student at CSB/SJU, and have never been diagnosed with an eating disorder by a medical professional. In a 20-minute interview, participants completed a 24-hour dietary recall led by the researcher and completed a short survey on breakfast consumption habits. The survey included questions about demographics and breakfast habits. Upon completion, each participant had the opportunity to provide an email address for a chance to win one of five $20 Visa gift cards. Tuesday-Friday appointments were the only available options for sign-up to control for college students' unpredictable eating and drinking habits over the weekends.

At each appointment, participants (n = 51) completed an informed consent form. Next the researcher took the participants weight, in pounds, using a TANTIA scale and height, in inches using a measuring stick. Participants removed shoes and heavy articles of clothing, if possible, before having their height and weight measured. For the 24-hour dietary recall, the researcher asked if the participant typically ate breakfast. Then they were asked to report everything that they ate and drank the entire day previous. The researcher collected information on food and beverages consumed, how much, for what meal (breakfast, lunch, dinner, or snack), brands of food, and participants told the researcher what restaurant they ate at, if applicable. Measuring

cups and spoons were available for participants to help them with remembering how much they ate of each food. Lastly, the participant filled out a survey on an iPad about their breakfast habits and demographics, like the one in the recruitment email.

After the completion of all the appointments, the researcher entered each 24-hour dietary recall into a nutrient analyzing software, ESHA, to help identify calories, macronutrients, and micronutrients each participant ate. Total nutrient intake and nutrient intake per 1,000 calories were calculated and compared by breakfast habits and gender. Analyzed nutrients included: calcium, fiber, potassium, iron, choline, magnesium, vitamin D, vitamin A, vitamin C, vitamin E, sodium, added sugar, total fat, and saturated fat. Participants' identities were kept protected and anonymous by having them provide the last four digits of a school-issued student ID. This ID identifies one participant from another. The ID number is not able to be tracked back to the participants, keeping participation anonymous. The formula (lbs/in^2) x 703 calculated BMI for each participant. An ANOVA and Touchy Test were used for statistical analysis in this study; statistical significance at $p \leq 0.05$.

Results

Originally, 51 participants completed the study. The exclusion of one participant occurred due to a lack of participation from their identified gender group. Final participants were n=50. Table 1 provides participant demographics and breakfast habits. Table 2 provides participant breakfast habits for each gender group. There was no significant difference in BMI, when comparing breakfast-eaters and breakfast-skippers (figure 1). Total calorie intake, as well as meal-specific calorie intake (lunch, dinner), is provided in figure 2. Total calories were significantly different ($p= 0.018$) between male and female breakfast-skippers. Male breakfast-skippers ate 2,497.08 $\pm$ 955.39 kcals while female breakfast-skippers ate 1,514.05 $\pm$ 510.22 kcals. Lunch calories were trending towards significance ($p= 0.075$) for an interaction between breakfast consumption*gender (figure 3). Dinner calories were not significantly different for breakfast consumption*gender (figure 4). Total potassium was the only nutrient that was significantly different between gender and breakfast consumption habits ($p= 0.015$) (figure 5). Male breakfast-eaters ate 1,507.6 $\pm$ 740.94 mg, male breakfast-skippers ate 2,523.17 $\pm$ 1,922.22 mg, female breakfast-eaters ate 1,661.95 $\pm$ 878.1 mg, and female breakfast-skippers ate 1,090.68 $\pm$ 652.81 mg. Fat intake (g) per 1,000 kcal was trending towards significance ($p= 0.067$) (figure 6) and calcium intake (mg) was also trending towards significance ($p= 0.078$) (figure 7). All of the other nutrients that were analyzed had no significant difference and were not close to being significant either.

Discussion

BMI, calorie intake, and nutrient intake are the main data analysis points of this study. Overall, dietary habits were similar, regardless of breakfast consumption habits. There was no difference in BMI among breakfast-eaters and breakfast-skippers, indicating that breakfast may have limited influence in energy balance.

Information found on the internet is not always evidence-based and may lead some people to believe in deceptive conclusions. One common theme about eating breakfast is that it helps boost

metabolism and can help assist with weight loss or maintenance. The composition of breakfast is more important than whether someone eats breakfast or not. Calorie intake only had a significant difference in total calorie intake. Male breakfast-skippers ate the most calories in a day while female breakfast-skippers ate the least amount of calories. The only nutrient that had a significant difference between gender and breakfast consumption groups was potassium. Male breakfast-skippers ate significantly more than both genders that ate breakfast and female breakfast-skippers. When comparing the nutrients in the diets of the participants in this study to RDAs, participants averaged below the recommendations for many nutrients. For example, college-aged males and females should be consuming 4,700 mg/day and 1,000 mg/day of potassium and calcium, respectively. The average consumption of these nutrients in the diets of the participants was 1,638 mg of potassium and 804 mg of calcium. Even though there was a significant difference in potassium in this study, college-aged people are still not eating the recommended daily intake.

Since there is a lot of conflicting data in previous research, this study has some similarities and differences between multiple studies. However, this is one of the few studies that used college students as participants. Other studies used BMI as a characteristic in the study, not a variable. Like this study, there was no difference in BMI among participants. No matter the age group, there is no difference in BMI whether someone skips or eats breakfast. For calorie intake, some other studies trended like this study in that there was no difference in lunch energy intake[3]. In one ad-libitum study, energy intake at lunch did differ between breakfast consumption groups[5]. Unlike this study, some studies found no difference in daily calorie intake[4]. Again, there was a lot of mixed results on breakfast studies and some studies did find a difference in total calorie intake[1]. Other studies found more statistically significant differences in nutrient intake than this study[2,4,6,7,8]. This can be due to the age group that was analyzed. College-aged people are not known for having a high-quality diet, therefore skipping breakfast or not can explain why there were not a lot of differences in nutrients consumed.

Seeing no difference in BMI could be expected due to the age group in this study. College-aged people are in a stage of life in which they are at their peak health, therefore there should not be a big difference in BMI between the two groups. Male breakfast-skippers ate more calories at lunch and dinner, causing them to have a higher daily intake of calories than any other group. In general, males eat more in a day due to increased needs of calories from increased energy expenditure and BMR. For the rest of the study, there was not much statistical significance in any of the other variables. This could be due to a lot of the students being on meal plans at CSB/SJU. This can have an impact on diet quality because there is not a lot of variety at college dining centers and students must eat what is available that day. Also, if participants made their food, there was not a lot of variety in foods that have nutrients in the 24-hour dietary recalls, such as vegetables and fruit. Fresh fruits and vegetables are expensive and college students may not be able to afford them, causing the students to buy similar cheaper options such as eggs, bread, pasta, canned vegetables, etc.

Limitations of this research include the possibility of inaccuracy in 24-hour recalls. There are a lot of variables that can lead to inaccurate results from this data collection method, such as

inaccurate reporting of the amount of food consumed, forgetting food and beverages consumed, or unsure of what specific kind of food the participant had. Another limitation includes only having teaspoons, tablespoons, and cup sizes for the participants to reference. Measuring of food can either be done with cups or ounces, depending on the type of food. This could have led to inaccurate input in the ESHA database. For example, meat is measured in ounces in ESHA, but participants reported in cups how much they ate. Another limitation is that the sample size was small and is therefore not representative of the college population. It is a requirement for CSB first-year and sophomore students to have an unlimited meal plan. This is a limitation because they then do not have full control of what they eat and must eat what is served that day at the dining center every day. Forced to have an unlimited meal plan for two years is a unique situation at CSB/SJU and is not representative of other colleges and universities. Also, weight was taken right away at the appointment. This could influence some people to lie about what they ate. Participants were able to see how much they weighed on the scale, and this could have persuaded people not to be truthful in telling the researcher their food and beverage consumption. Finally, vitamin supplements were not a part of the 24-hour dietary recall. This could have altered the nutrient intake of some participants who consume their nutrients in a form of a supplement.

For future research, the researcher would like to have people take a picture of what they ate and then bring those to the appointment. This will help accurately show the researcher how much each participant ate. Also, reporting inaccuracies would decrease if participants kept a journal. Obtaining data from multiple colleges and universities would help increase the study's validity. This would be more representative of college students. Another possible study that could be done, is by comparing various age groups to college students. Doing this can show if eating or skipping breakfast impacts different age groups.

Conclusion

Overall, eating or skipping breakfast does not have a big impact on dietary habits or BMI. There was no statistical significance in BMI, lunch calories, dinner calories, and all but one nutrient in the two breakfast consumption groups and gender. The only significance in this study includes potassium intake and total daily calorie intake. Eating or skipping breakfast does not guarantee a healthier diet in college students. College students are not eating enough of essential nutrients, whether they ate or skipped breakfast.

Acknowledgements

Thank you to my advisor Dr. Emily Heying for all the work and help she has done for me throughout this project. Thank you to the CSBSJU Undergraduate Research Program for funding this research.

Appendix

Table 1.

Participant Demographics

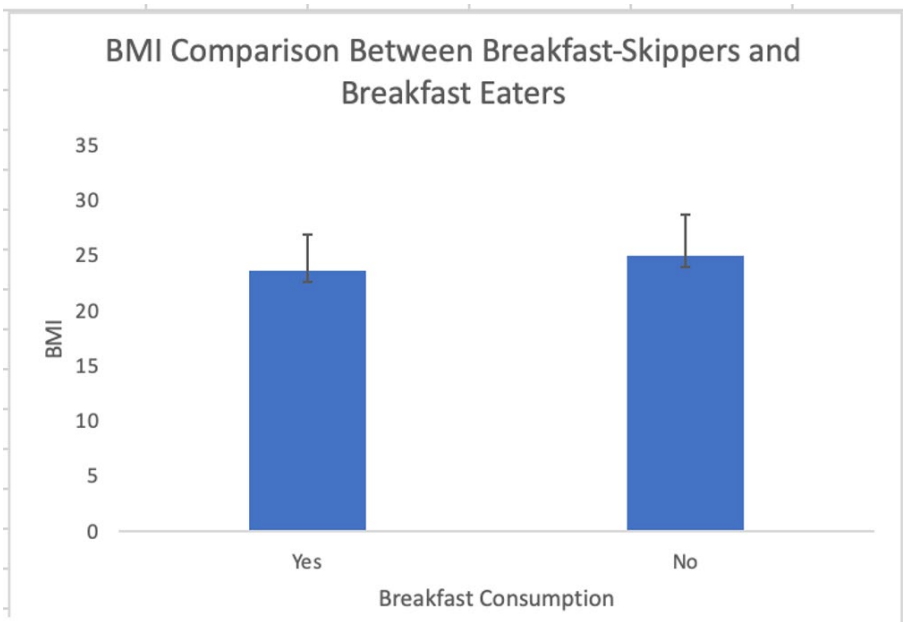
Gender	**Number of Participants** (total n = 50)
Male	16
Female	34
Major	
Nutrition	6
Non-nutrition	44
Academic Year	
First-Year	10
Sophomore	12
Junior	9
Senior	19
Breakfast Consumption	
Yes	31
No	19

Table 2.

Breakfast Habits Broken Down by Gender

Gender and Breakfast Consumption	**Number of participants** (total n=50)
Males Yes	9
Males No	7
Females Yes	22
Females No	12

Figure 1.



There is no significant difference in BMI in breakfast-skippers and breakfast-eaters

Figure 2.

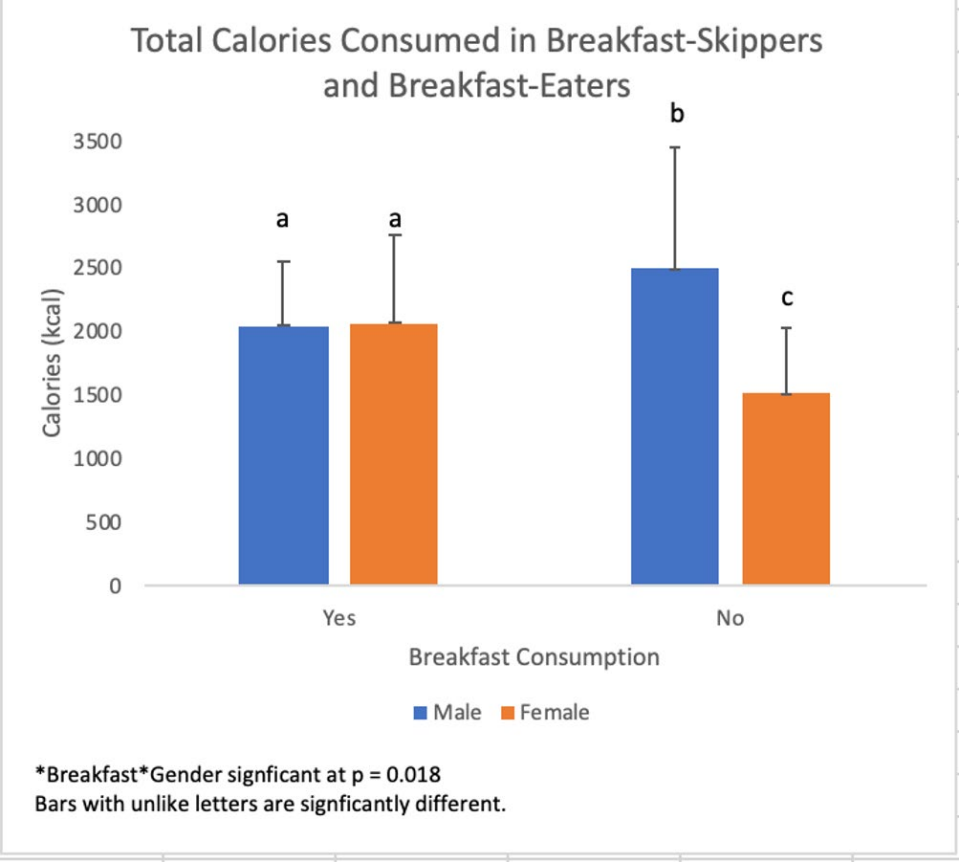

Total Calories Consumed in Breakfast-Skippers and Breakfast-Eaters
3500
3000
2500
2000
1500
1000
500
0
Calories (kcal)
a
a
b
c
Yes
No
Breakfast Consumption
Male
Female
*Breakfast*Gender signficant at p = 0.018
Bars with unlike letters are signficantly different.

Figure 3.

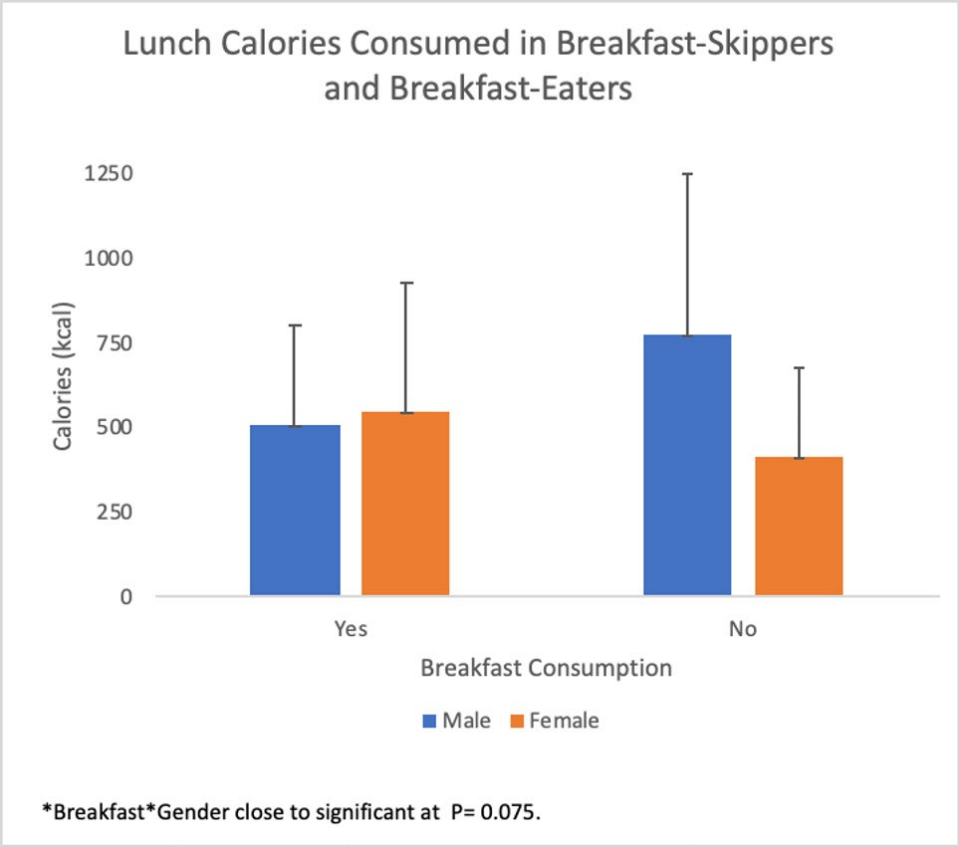

Lunch Calories Consumed in Breakfast-Skippers and Breakfast-Eaters
1250
1000
750
500
250
0
Calories (kcal)
Yes
No
Breakfast Consumption
Male
Female
*Breakfast*Gender close to significant at P= 0.075.

Figure 4.

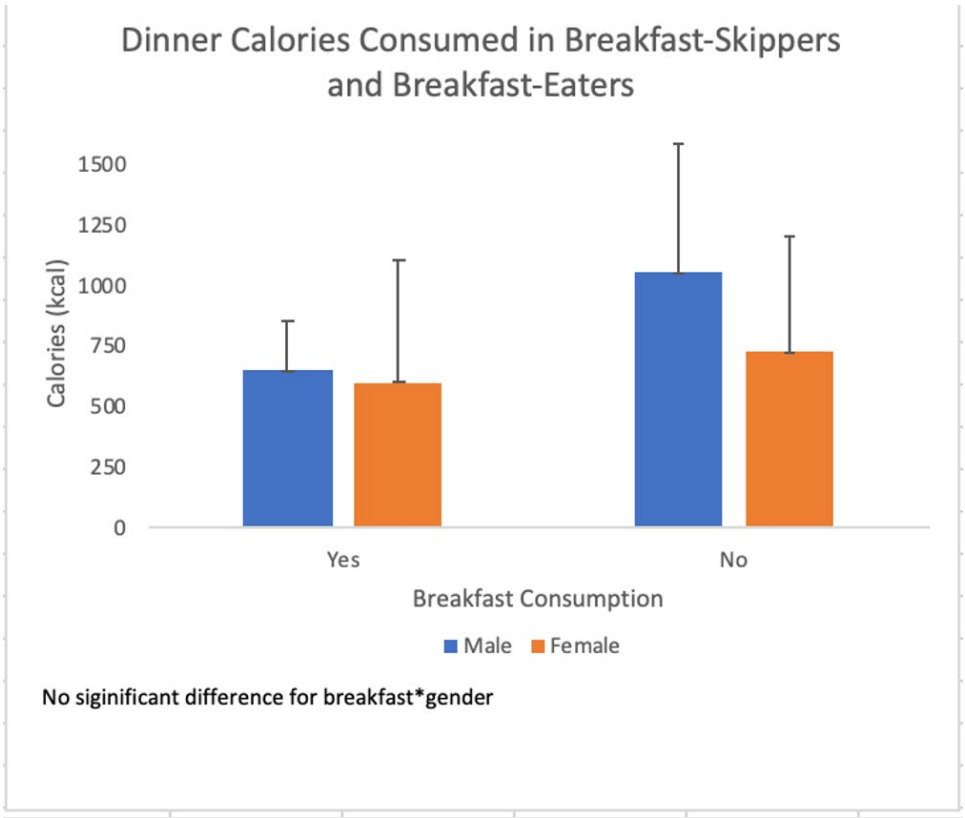
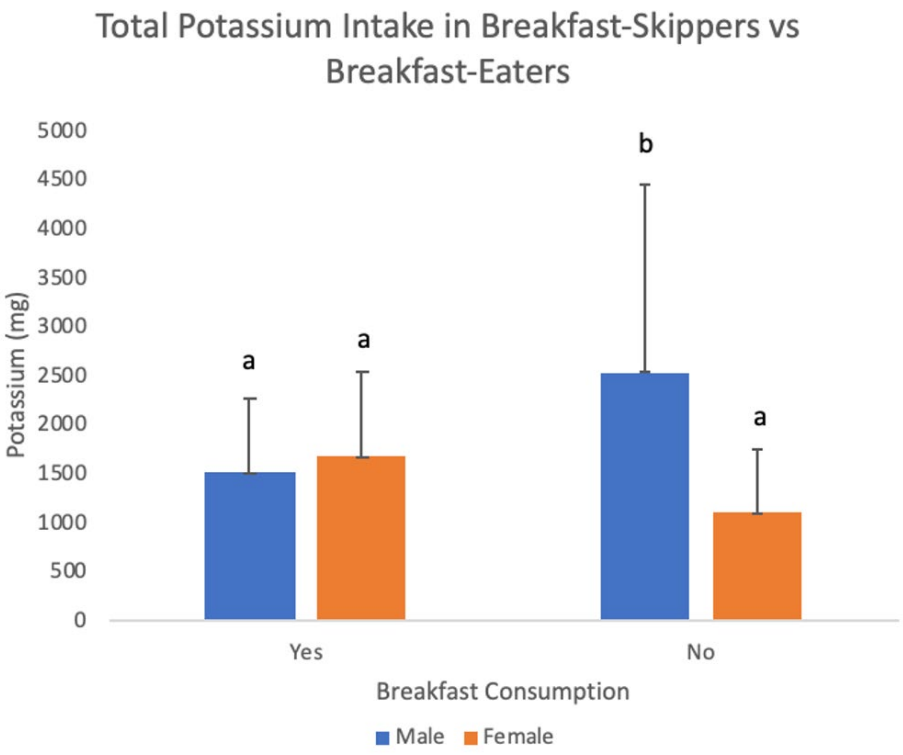

Dinner Calories Consumed in Breakfast-Skippers and Breakfast-Eaters
1500
1250
1000
750
500
250
0
Calories (kcal)
Yes
No
Breakfast Consumption
Male
Female
No siginificant difference for breakfast*gender

Figure 5.



*Breakfast*gender significant at P= 0.015
Bars with unlike letters are significantly different.

Figure 6.

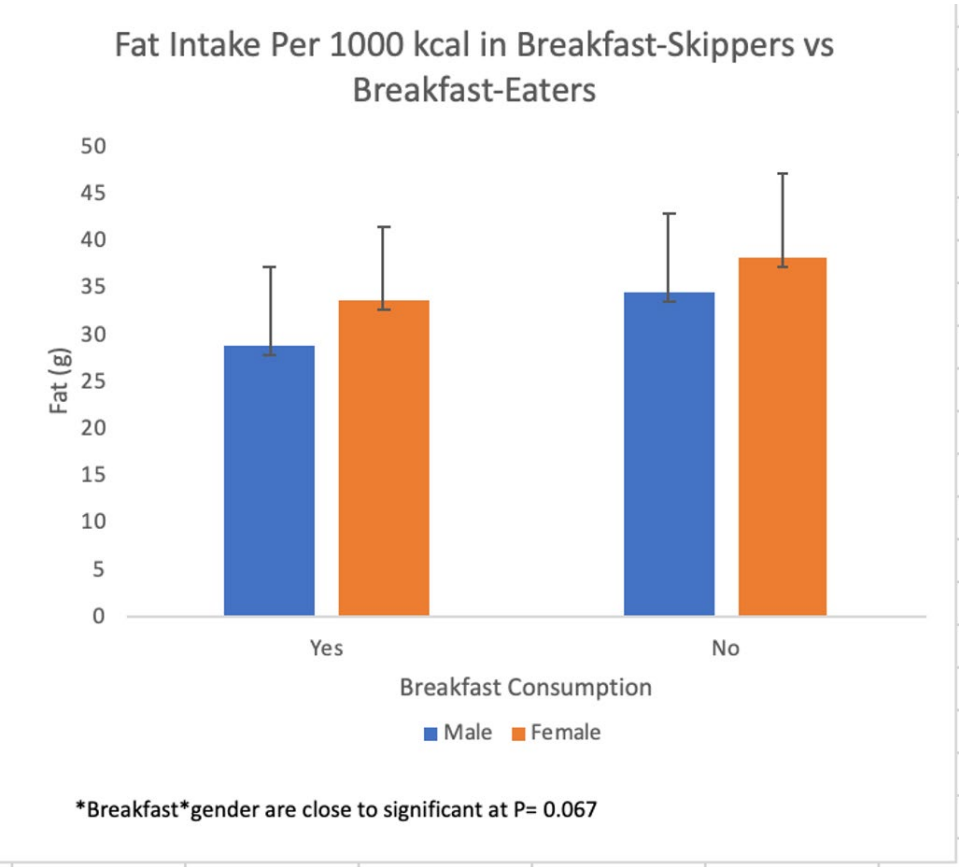
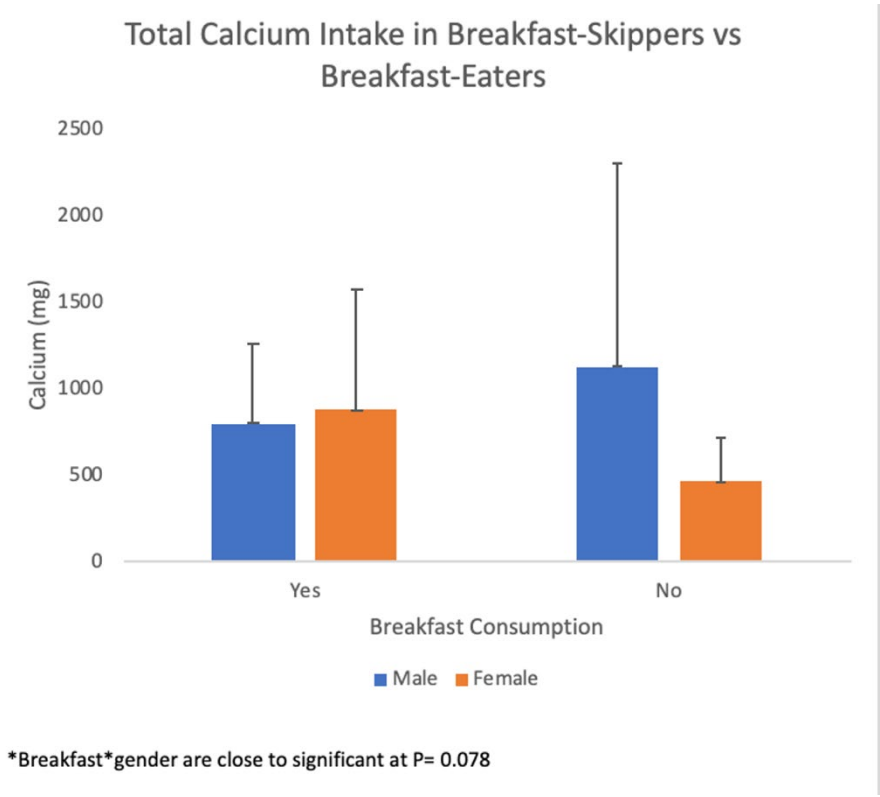

Fat Intake Per 1000 kcal in Breakfast-Skippers vs Breakfast-Eaters
50
45
40
35
30
25
20
15
10
5
0
Fat (g)
Yes
No
Breakfast Consumption
Male
Female
*Breakfast*gender are close to significant at P= 0.067

Figure 7.



*Breakfast*gender are close to significant at P= 0.078

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