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The influence of eating habits on the academic performance of university students

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ABSTRACT
Objective: To explore the correlation between eating habits of university students and academic achievement.
Participants: 577 undergraduate students at a university in the United States.
Methods: Students were invited to participate in an anonymous online survey that asked questions concerning health-related behaviors; participants were asked to report their current grade point average (GPA). Statistical analyses were performed using the JMP software program; a standard least squares regression was used to test whether self-reported current GPA was related to different types and rates of weekly food and drink consumption.
Results: Self-reported GPA did not change along with weekly rates of milk, vegetables, green salad, fruit juice, or fresh fruit consumption. Breakfast consumption had a positive effect on self-reported GPA, while fast food consumption had a negative effect.
Conclusion: Healthy eating habits have a positive effect on students' academic performance. However, other factors, such as sleep habits, may be more important.

Introduction

With more focus being placed on grade point average (GPA) and overall academic performance in college, it is important to explore how life style factors, particularly eating behavior, can influence students' academic success. As high schoolers transition to college, oftentimes their health-related habits will change as they adjust to new resources, lack of parental guidance, and a different environment.[1] It has been widely acknowledged that university students are far from reaching the public, national, and global health recommendations when it comes to dietary patterns.[2,3] Whereas a student's university career requires clear nutrition priorities and dietary habits, their eating behaviors can negatively impact cognitive function, and, consequently, fail to properly support scholastic demands.[4,5] To make matters even worse, these negative behaviors tend to worsen further as students progress through college.[4]

A number of published studies have explored the correlation of eating habits and associated GPA/grades; however, most of this research focused on students in Pre-K through high school.[6,7] On the other hand, there are only a limited number of studies concerning college students.[8,9] Nonetheless, these studies are consistent with providing evidence that poor eating habits adversely impact academic performance, while healthy dietary behaviors are favorable predictors of academic success.[3]

Although some studies reported higher academic achievement for college students who consumed a greater volume of fruits and vegetables, it has also been reported that a vast majority of undergraduates do not meet the recommended daily serving of fruits and vegetables.[1,9–11] When college students did consume a larger amount of produce, their GPA was enhanced by as much as 0.15 points.[3] A systematic review on the relationship between eating habits and academic success for university students looked at seven different studies and found that five of those reported higher academic achievement with increased fruit intake.[9] Alternatively, students who had an increased intake of fast food experienced a decrease in GPA in another study.[12]

Breakfast consumption has also been proven to strengthen scholastic achievement as well as being essential in developing a wholesome positive lifestyle. Breakfast increases glucose levels which in return can lead to improved memory, immediate recall, attention span, and, subsequently, to improved test grades.[6–8,13,14] Phillips's study[8] found that students who ate some type of breakfast before exams had a higher passing rate than students who did not. Benton and Parker[13] showed that fasting in the morning negatively affects the ability to remember word lists, and lectures, as well as the recall of items while counting backwards.

The topic of food insecurity should also be considered when observing how nutrition affects students' classroom

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performance. Students are particularly susceptible to food insecurity because of the rising costs of attending university.[15] The inaccessibility of balanced food sources tends to guide individuals to undernourishment or negative food behaviors such as an elevated consumption of fast food and soft drinks.[10] These patterns undesirably impact intellectual development, capability to work productively, and compromises students' complete health.[16] The majority of students facing food insecurities also reported adverse effects on their academic performances as well as an inability to concentrate, which led to failed exams or withdrawing from courses.[15]

Most of the studies involving college students have looked at risky health behaviors such as drug and alcohol use rather than routines that are encouraging health.[3,9] The review by Burrows et al.[9] confirmed that college students are an understudied population in regard to eating habits that foster academic success. Burkhalter and Hillman[5] stated that the study of college students' health behaviors and their relationship to academic achievement is in its infancy. The purpose of this study was to further explore the influence eating habits of university students have on their overall academic performance by using GPA as an outcome measure. It was hypothesized that academic performance of college students would be better when healthy eating behaviors were practiced more frequently.

Methods

Ethical research statement

The research protocol and its amendment were approved by an ethical review board (Institutional Review Board (IRB)) at Florida Gulf Coast University (FGCU) prior to data collection (FGCU IRB 2018-17, March 30, 2018). All researchers involved in the study were trained in ethical data collection through the Collaborative Institutional Training Initiative (CITI). Data collection followed all laws relevant to the survey of university student populations.

Data collection

Data were collected over three semesters (Spring 2018, Fall 2018, and Spring 2019) between April 1, 2018 and January 31, 2019 using an anonymous online survey (Appendix 1). In order to reach as many students from different majors as possible, instructors from all colleges at FGCU were asked for permission to invite students in their classes to take the survey titled "Student Health Behavior and Academic Success." Students enrolled in those classes as well as the classes of the study PI were invited to participate in the online survey.

The first page of the survey consisted of an IRB (IRB) approved online survey consent form; in other words, consent was obtained. Participation in the study was completely voluntary and students were free to change their mind and stop participation at any time, for any reason, without penalty or loss of any future services they may be eligible to receive from the university.

The survey consisted of five groups of questions around health and wellness, requesting information – among other topics – regarding demographic information, such as gender, age, ethnicity/race, year at school, and current overall grade point average (GPA), and about eating habits and fluid intake. Most of the questions were modeled after questions used in the 2017 Standard High School Youth Risk Behavior Survey (YRBS).[17]

Participants were asked to provide their current overall GPA as well as the overall GPA at the end of their freshman year if they were sophomore, junior or senior students, their overall GPA at the end of their sophomore year if they were junior or senior students, and their overall GPA at the end of their junior year if they were senior students (see Appendix 1). However, for the purpose of this article only the self-reported current GPA was used.

Regarding healthy eating habits, participants were asked how many times during the past seven days they had eaten vegetables, fruit, or green salad, or had consumed 100% fruit juice or a glass of milk. The answer options were 0 times (not at all), 1 to 3 times, 4 to 6 times, 7 to 10 times, and 11 times or more for eating vegetables, fruit or green salad as well as for drinking fruit juice. For drinking milk, the answer options were 0 glasses (not at all), 1 to 3 glasses, 4 to 6 glasses, 7 to 10 glasses, and 11 glasses or more (see Appendix 1). Participants were also asked how often during the past seven days they had consumed a can, glass or bottle of soda, diet soda, energy drink, or sports drink. The answer choices were 0 times (not at all), 1 to 3 times, 4 to 6 times, 7 to 10 times, and 11 times or more (see Appendix 1). Finally, participants were asked to provide information on the number of times they ate breakfast on a weekly basis (scale: 0 days per week to 7 days per week) as well as the number of times per week they consumed fast food (Appendix 1).

Data analyses

For questions with categorical answers, data are presented as percentage of the total participant pool, or a portion of this pool. For questions with quantitative answers, data are presented as means with standard deviations. Sample sizes vary for different analyses due to the voluntary nature of the survey, but are indicated. All statistical analyses were performed using the JMP software program (JMP®, Version 14; SAS Institute Inc., Cary, NC, USA). A standard least squares regression was used to test whether self-reported current GPA (scale: 0.00 to 4.00) was related to different types and rates of weekly food and drink consumption.

Results

Study population

The online survey was completed by 653 students. However, 76 responses were excluded from data analysis because they indicated an age younger than 18 years of age or did not provide a current GPA. Of the 577 study responses analyzed, 79.7% were from female students ($n = 460$) and 20.3%
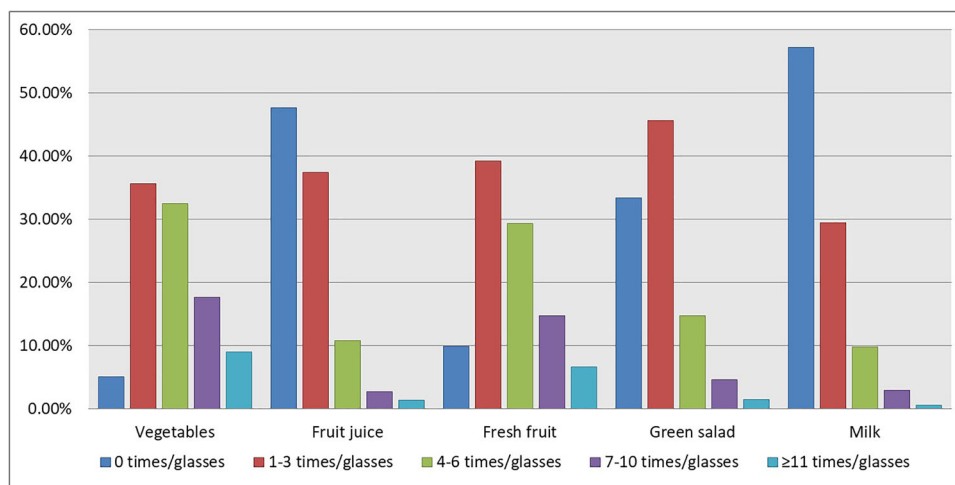
Figure 1. Percentage of survey participants consuming vegetables, 100% fruit juice, fresh fruit, green salad, and milk for different categories of consumption.

from male students ($n = 117$). Students from the freshman class made up 31.4% ($n = 181$) of participants; sophomores made up 30.0% ($n = 173$), juniors 25.5% ($n = 147$), and seniors 11.6% ($n = 67$). Second degree-seeking students and graduate students made up less than 1% of the total responses each (0.4% and 0.5% respectively). Four participants (0.7%) did not provide information. Almost all study participants were full-time students (96.0%; $n = 554$); only 15 students (2.6%) were part-time students. Eight participants (1.4%) did not provide information.

The mean age of respondents was 19.57 ± 1.38 years (mean ± standard deviation; range: 18–25 years; median age $= 19$ years). The majority of respondents identified as Caucasian/White ($n = 337$, 58.6%), Hispanic ($n = 94$, 16.3%), or African-American/Black ($n = 34$, 5.9%). Respondents identifying as East Asian or Non-Hispanic made up 1.2% of the respondents each ($n = 7$). All other respondents identified as more than one ethnicity/race or as an ethnicity/race other than the ones listed above ($n = 96$, 16.7%). Two respondents did not provide information.

Slightly more than 40% of respondents (42.8%; $n = 247$) were students in the College of Arts & Sciences, 34.7% ($n = 200$) were students in the Marieb College of Health & Human Services, 9.4% ($n = 54$) were from the Lutgert College of Business, 6.8% ($n = 39$) from the U.A. Whitaker College of Engineering, and 4.3% ($n = 25$) from the College of Education. Twelve respondents (2.1%) did not provide a college affiliation or were connected with two colleges.

The average current GPA was 3.37 ± 0.53 (mean ± standard deviation; range: 0.40–4.0; median GPA = 3.5).

Healthy eating habits and GPA

When asked how many times in seven days they had consumed vegetables, fruit, green salad, 100% fruit juice, or a glass of milk, participants' responses varied widely (Figure 1). Six out of ten respondents (60.4%) had consumed green salad 1–6 times per week and almost 70% had eaten vegetables (68.1%) and fresh fruit (68.6%) 1-6 times per week. Fruit juice and milk consumption was lower;

almost half of participants (47.7%) had not had any fruit juice during the past seven days and even more participants (57.2%) had not had a glass of milk during the same time period. Vegetables and fresh fruit were the only healthy foodstuff consumed 11 times or more over the previous seven days by more than 20% of participants.

Self-reported GPA did not change along with weekly rates of milk, vegetables, green salad, fruit juice, or fresh fruit consumption (Table 1, $p > 0.0758$). Participants who reported having drunk seven glasses of milk or more over the past seven days reported the highest GPAs (3.60 ± 0.37 for participants who had 7–10 glass, 3.68 ± 0.35 for participants who had 11 glasses or more), followed by participants who had consumed green salad 11 times or more (3.61 ± 0.30; Figure 2). However, the percentage of participants reporting these behaviors was rather low at 1.7% for eating green salad 11 times or more, 3% for drinking 7–10 glasses of milk, and 0.6% for drinking 11 glasses of milk or more.
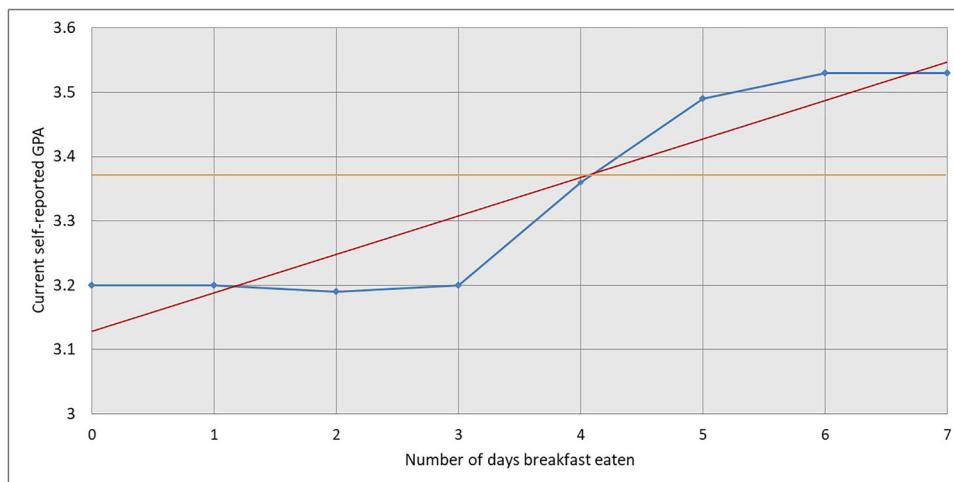
Breakfast consumption and GPA

The average current self-reported GPAs for participants who did not eat breakfast (9.4% of participants; $n = 51$) or on one day (9.2% of participants; $n = 50$), two days (11.6% of participants; $n = 63$) or three days per week (11.6% of participants; $n = 63$) were below the average GPA for all participants (3.37 ± 0.53; Figure 3) The average GPA of students who had breakfast on four days (3.36 ± 0.57; 8.9% of participants; $n = 48$) was very close to the average GPA, while the GPAs for students who had eaten breakfast on five days (8.7% of participants; $n = 47$), six days (6.8% of participants; $n = 37$) or seven days (32.5% of participants; $n = 176$) were above the average GPA at 3.49 ± 0.42, 3.53 ± 0.41, and 3.53 ± 0.37 respectively.

Participants' self-reported current GPA increased significantly with the number of days that they reported eating breakfast per week (Regression, DF $= 1$, $R^2 = 0.07$, F-Ratio $= 41.4211$, $p < 0.0001$; Table 1).

Table 1. Relationship between different types of eating habits among university students and self-reported current GPA using standard least squares regressions or a Kruskall Wallis Rank Sums Test (individuals as replicates).

Eating habit	Independent variable	Sample size	Test results	p Value
Consumption of vegetables	Number of times items consumed per week (categorical data)	542	DF = 4, F-Ratio = 1.1232, R^2 = 0.008	0.3446
Consumption of 100% fruit juice	Number of times items consumed per week (categorical data)	540	DF = 4, F-Ratio = 1.3536, R^2 = 0.01	0.2489
Consumption of fresh fruit	Number of times items consumed per week (categorical data)	541	DF = 4, F-Ratio = 2.1303, R^2 = 0.02	0.0758
Consumption of green salad	Number of times items consumed per week (categorical data)	541	DF = 4, F-Ratio = 1.2274, R^2 = 0.009	0.2981
Consumption of milk	Number of times items consumed per week (categorical data)	542	DF = 4, F-Ratio = 1.3868, R^2 = 0.01	0.2372
Breakfast consumption	Number of days breakfast consumed per week (scale: 0-7, continuous numeric)	541	DF = 1, F-Ratio = 41.4211, R^2 = 0.07	<0.0001
Fast food consumption	Number of times items consumed per week (categorical data)	542	DF = 3, Chi-Square = 16.6355	0.0008

Figure 2. Frequency of vegetables, 100% fruit juice, fresh fruit, green salad, and milk and self-reported grade point average (GPA). Mean GPA for all participants (3.37) indicated by orange line.

Figure 3. Frequency of eating breakfast and self-reported grade point average (GPA). Mean GPA for all participants (3.37) indicated by orange line. Trendline in red.

Fast food consumption and GPA

Eight-three percent of 542 participants who reported on their fast food consumption had not eaten fast food during the past seven days (26.2%; $n = 142$) or had eaten it only 1–3 times (56.8%; $n = 308$). Only 20 participants (3.7%) had eaten fast food more or less daily in the past week (2.2%; $n = 12$; 7–10 times; 1.5%; $n = 8$; ≥11 times), while 72 students (13.3%) reported consuming it 4–6 times.

The average self-reported GPAs for the different categories of fast food consumption were 3.46 ± 0.44 (0 times fast
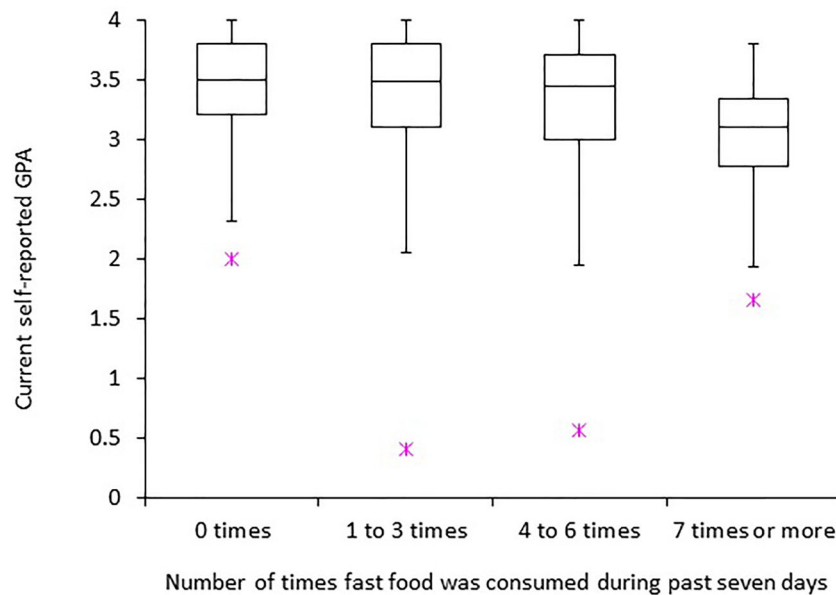
Figure 4. Box and whisker chart of self-reported current GPA across respondents' rates of fast food consumption. Ends of whiskers are set at 1.5 times the inter-quartile range and minimum and maximum values outside this range are shown as outliers.

food consumed), 3.37 ± 0.56 (1–3 times), 3.29 ± 0.58 (4–6 times), and 2.99 ± 0.55 (7–10 times and more). Participants' self-reported current GPA changed with the number of days that they reported eating fast food per week (Kruskal-Wallis Rank Sums Test, DF = 3, Chi-square = 16.6355, $p = 0.0008$; Table 1), with students who had fast food at least 7 times in the past week having significantly lower current GPAs than students who had not eaten any fast food in the last week (Steel-Dwass post-hoc test; $p = 0.0007$) or only 1–3 times in the past week (Steel-Dwass post-hoc test; $p = 0.0052$; Figure 4).

Discussion

This study increases knowledge about the correlation between student dietary behavior and academic performance measured as GPA on the strength of data collected from 577 students at a regional American university. In our study, we find a positive correlation between healthy eating habits, especially daily or almost daily breakfast consumption, and self-reported GPA. Conversely, increased fast food consumption is correlated with a lower self-reported GPA.

The results indicating that college students' diet most of the time falls short of recommendations are in line with previous studies.[2,3] However, there is no indication that our study participants suffered from undernourishment or food insecurity. One has to keep in mind that dietary choices on campus are often influenced by factors such as financial considerations, whether or not students are on a meal plan, and by the choices offered. For example, most food outlets, especially those selling fast food, do not offer fresh fruit juice or milk as a standard option when ordering a meal. The same applies to some extent to fresh food and green salad.

Although there are studies indicating that healthy eating habits, especially consumption of fruit and vegetables, lead to higher academic achievement, our study did not show a

positive correlation between healthy eating habits and self-reported GPA (Table 1). However, the data generally point at a positive correlation (Figure 1); a greater sample size may have confirmed those previous studies. For example, the average self-reported GPA for milk consumption is greater for participants who drank seven or more glasses over the last seven days than for those who drank no milk or less than four glasses. But, because of the small proportion of participants who drank seven glasses or more (3.6%, $n = 19$), the p-value did not indicate significance.

Breakfast consumption has a proven track record for supporting academic achievement in high school and college students.[6,7] Phillips[8] reported a significant difference in exam scores in biology exams between students who consume breakfast and those who do not. Trockel et al.[14] found a correlation between eating breakfast and GPA in first year college students. Our study results reinforce those findings; students who ate breakfast on five days or more reported a significantly higher current GPA than students who had breakfast on three days or fewer (Table 1, Figure 3). However, the value of 0.07 for R^2 indicates that there are other factors that explain the higher GPA better and that only 7% of the variability in the dataset can be explained by how often students eat breakfast. Having breakfast may just be an indicator of other behaviors shared by students who are likely to have good grades and, also, there are other factors that are more important. For example, Trockel et al.[14] found that students who get up early have better grades than students who sleep in. One could hypothesize that students who get up early are more likely to eat breakfast leading to a cumulative effect on their academic performance.

Fast food consumption, on the other hand, has been linked to lower academic achievement. Therefore, the results of our study are in line with previous studies. Deliens et al.[10] reported that students with a higher fast food intake, French fries in their study, were more likely to have a lower GPA and to not show up for exams. Kobayashi[12] and

Farahbakhsh et al.[15] also showed that unhealthy eating habits that include fast food consumption result in lower academic achievements.

The main limitations of our study were participant selection and reliance on self-reported dietary behaviors and grade point averages. Although we invited students from all colleges and a variety of courses to participate in our survey, the composition of our study population, with 79.7% female and 20.3% male participants, does not reflect the demographics of the FGCU student body (53% female students and 47% male students).[18] One reason for having more female participants could be that women are more likely to participate in online surveys in general.[19] Female students are also more interested in or worried about health-related issues and diet, which could also be a factor for their increased participation.[20] However, there are no studies we know of that would suggest that the effects of healthy or unhealthy eating habits depends on the gender of the students.

Survey participants may not have given accurate information in their responses. Some of them may not have remembered how often they ate fast food during the last week, for example, or may have wanted to appear living a heathier lifestyle than they actually do. Others may have been ashamed of their low GPA or reported a GPA they hoped to achieve by the end of the semester. While these factors may have influenced the results of a study with a small sample size, having a study population of almost 600 participants minimizes the effect incorrect information could have on our study results.

Conclusion

Our study found that breakfast consumption, i.e. the number of days students consume breakfast per week, has a positive effect on their self-reported GPA. Students who had breakfast on at least five days per week reported a significantly higher GPA than students who had breakfast on three days or fewer. However, there are other factors, such as sleep habits and hours worked, that may have a greater positive or negative influence on student grades than eating breakfast.

Fast food consumption, on the other hand, has a negative effect on student achievement. Students who had fast food at least seven times in the past week reported significantly lower current GPAs than students who had eaten fast food less than four times or not at all.

Acknowledgments

Conflict of interest disclosure

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References

1. Wengreen H, Moncur C. Change in Diet, Physical Activity, and Body Weight among Young-Adults during the Transition from High School to College. *Nutr J.* 2009;8(1):32–38. doi:10.1186/1475-2891-8-32.

2. Center for Disease Control and Prevention. Youth Risk Behavior Surveillance: National College Health Risk Behavior Survey—United States, 1995. *MMWR CDC Surveill Summ.* 1997;46:1–56.

3. Wald A, Muennig PA, O'Connell KA, Garber CE. Associations between Healthy Lifestyle Behaviors and Academic Performance in U.S. Undergraduates: A Secondary Analysis of the American College Health Association's National College Health Assessment II. *Am J Health Promot.* 2014;28(5):298–305. doi:10.4278/ajhp.120518-QUAN-265.

4. Grace T. Health Problems of College Students. *J Am Coll Health.* 1997;45(6):243–251. doi:10.1080/07448481.1997.9936894.

5. Burkhalter T, Hillman C. A Narrative Review of Physical Activity, Nutrition, and Obesity to Cognition and Scholastic Performance across the Human Lifespan. *Adv Nutr.* 2011;2(2):201S–206S. doi:10.3945/an.111.000331.

6. Adolphus K, Lawton C, Dye L. The Effects of Breakfast on Behavior and Academic Performance in Children and Adolescents. *Front Hum Neurosci.* 2013;7:42. doi:10.3389/fnhum.2013.00425.

7. Rampersaud G, Pereira M, Girard B, Adams J, Metzl J. Breakfast Habits, Nutritional Status, Body Weight, and Academic Performance in Children and Adolescents. *J Am Diet Assoc.* 2005;105(5):743–760. doi:10.1016/j.jada.2005.02.007.

8. Phillips G. Does Eating Breakfast Affect the Performance of College Students on Biology Exams? *Bioscene.* 2005;30(4):15–19.

9. Burrows T, Whatnall M, Patterson A, Hutchesson M. Associations between Dietary Intake and Academic Achievement in College Students: A Systematic Review. *Healthcare.* 2017;5(4):60. doi:10.3390/healthcare5040060.

10. Deliens T, Calrys P, De Bourdeaudhuij I, Deforche B. Weight, Socio-Demographics, and Health Behaviour Related Correlates of Academic Performance in First Year University Students. *Nutr J.* 2013;12:1–14. doi:10.1186/1475-2891-12-162.

11. Kristjánsson Á, Sigfúsdóttir I, Allegrante J. Health Behavior and Academic Achievement among Adolescents: The Relative Contribution of Dietary Habits, Physical Activity, Body Mass Index, and Self-Esteem. *Health Educ Behav.* 2010;37(1):51–64. doi:10.1177/1090198107313481.

12. Kobayashi F. Academic Achievement, BMI, and Fast Food Intake of American and Japanese College Students. *Nutr Food Sci.* 2009;39(5):555–556. doi:10.1108/00346650910992213.

13. Benton D, Parker P. Breakfast, Blood Glucose, and Cognition. *Am J Clin Nutr.* 1998;67(4):772S–778S. doi:10.1093/ajcn/67.4.772S.

14. Trockel M, Barnes M, Egget D. Health-Related Variables and Academic Performance among First-Year College Students: Implications for Sleep and Other Behaviors. *J Am Coll Health.* 2000;49(3):125–131. doi:10.1080/07448480009596294.

15. Farahbakhsh J, Hanbazaza M, Ball GDC, Farmer AP, Maximova K, Willows ND. Food Insecure Student Clients of a University-

Based Food Bank Have Compromised Health, Dietary Intake and Academic Quality. *Nutr Diet.* 2017;74(1):67–73. doi:10.1111/1747-0080.12307.

16. Nasir J, Tahir M. Factors Affecting Nutritional Attitudes among University Adults. *Pak J Commer Soc Sci.* 2017;11(2): 644–652.

17. Center for Disease Control and Prevention. Standard High School Youth Risk Behavior Survey (YRBS). Available at: https://www.cdc.gov/healthyyouth/data/yrbs/pdf/2017/2017_yrbs_stand-ard_hs_questionnaire.pdf. Published 2017. Accessed August 13, 2019.

18. Florida Gulf Cost University. Fast Facts. Available at: https://www.fgcu.edu/about/fastfacts.aspx. Published 2019. Accessed August 13, 2019.

19. Smith WG. Does Gender Influence Online Survey Participation? A Record-Linkage Analysis of University Faculty Online Survey Response Behavior. Available at: https://files.eric.ed.gov/fulltext/ED501717.pdf. Published 2008. Accessed August 13, 2019.

20. Rozin P, Bauer R, Catanese D. Food and Life, Pleasure and Worry, among American College Students: Gender Differences and Regional Similarities. *J Pers Soc Psychol.* 2003;85(1):132–141. doi:10.1037/0022-3514.85.1.132.