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**The Effects of Studying Abroad in Port Elizabeth, South Africa on Exercise and
Nutrition Habits of College Students.**

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Introduction

College students all around the United States go on study abroad programs each year and many of them fail to maintain healthy diet and exercise habits (King, Vidourek, English, & Merianos, 2014). Many college students struggle with stress traveling to a new country and returning home from their experience abroad. Some of the first habits to be sacrificed due to the stress is healthy eating and exercise (King, Vidourek, English, & Merianos, 2014). More often than not students claim that this is a result of high amounts of work (King et al., 2014). Many factors play into determining the exercise and nutrition habits of college students including: location of the university, location of living (on or off campus), time, ethnicity, sex, and academic studies (Daskapan, Tuzun, & Eker, 2006; Dean Keating, Guan, Castro Pinero, & Bridges, 2005; Kelley & Sharpe Kelley, 1994; King et al., 2014; Peachey & Baller, 2015). Another common coping mechanism employed by college students is alcohol. Stress drinking while abroad and upon returning is extremely common when students struggle with managing stress (Pedersen, 2010; Wielkiewicz, 2010). Consistent exercise also plays a significant role in managing stress. Exercise improves the flow of blood to the brain and contributes to the regulation of hormones that play various roles in stress and anxiety (Jackson, 2013). Student nutrition is crucial for function of everyday life. Therefore, it is important to understand the diet and exercise habits of college students and how they affect the overall physical and mental wellbeing of the students.

Diet and exercise habits of college students can be affected by many factors listed above (Daskapan, Tuzun, & Eker, 2006; Dean Keating, Guan, Castro Pinero, & Bridges, 2005; Grubbs & Carter, 2002; Kelley & Sharpe Kelley, 1994; King, Vidourek, English, & Merianos, 2014; Lemoyne, Valois, & Guay, 2015; Lieberman et al., 2015; Papadaki, Hondros, Scott, & Kapsokefalou, 2007). However, the literature studying diet and exercise habits of students abroad is severely limited. Various alcohol consumption questionnaires have been given to students studying abroad and at home. These questionnaires are only looking at the trends in alcohol consumption, which tend to increase abroad and post study abroad in students and has a negative effect on wellbeing (Pedersen, Cruz, LaBrie, & Hummer, 2011; Pedersen, LaBrie, & Hummer, 2009; Pedersen, LaBrie, Hummer, Larimer, & Lee, 2010; Pedersen, Larimer, & Lee, 2010; Pedersen, Skidmore, & Aresi, 2014). Many of these consumption habits can be significantly decreased when proper acculturation orientations are implemented at the start of the program to make the students feel at home, rather than an outsider (Pedersen, Neighbors, Larimer, & Lee, 2011; Pedersen, Neighbors, Lee, & Larimer, 2012). Students struggle with culture shock—the experience of entering a new culture that is different from their own—when traveling abroad. While culture shock is difficult for many students, reverse culture shock is often more trying. Reverse culture shock is experienced on the reentry into their home culture. Little research has been done to better understand how study abroad affects the entire diet of students and their physical activity habits.

It is important to continue to understand how study abroad effects students' wellbeing and how study abroad programs can have success in encouraging health habits abroad and upon reentry. Study abroad advisors and organizers can benefit from better

understanding the wellbeing of their students and the possible changes in their habits that can occur abroad. As guides throughout the program, advisors should be conscientious of the possible stressors for students and look for warning signs of diminishing student health (i.e. poor exercise habits, nutritional habits, or increased alcohol consumption). The tools used to measure diet and exercise habits of college students abroad and at home were Fitbit Charge activity monitors (measure step count), Lange skinfold calipers (measure body composition via ACSM's seven site skinfold method), and the Alternative Healthy Eating Index-2010 (measure dietary trends). Our hypothesis is as follows: that steps taken abroad will be greater than on-campus, and nutritional habits will be significantly less healthy while abroad in comparison to on-campus.

Methods

The design of this study is descriptive research that spans the course of two semesters of study. The independent variables for the study were time and location. The dependent variables of the study were nutrition consumption habits in the following categories: dairy, fruit, vegetables, protein, processed grains, added sugar, and alcohol; steps taken per day on average, and body fat percentage throughout the semesters both abroad and on campus.

Subjects

All subjects were recruited from the South Africa Study Abroad program through the College of St. Benedict/St. John's University. There were a total of sixteen participants (male = 5, female = 11) ranging in age from 20-22. All subjects are considered "physically active", which is defined as participating in three moderate-

intensity exercise sessions per week for at least 90 minutes total (Sell, 2012). No subjects sustained any lower extremity injury throughout the course of the study that hindered them from participating in physical activity. Subjects were split randomly into two cohorts to compensate for the limited number of available activity monitors.

Equipment/Procedures

Subjects took part in four testing blocks over the course of two semesters, one abroad in Port Elizabeth, South Africa and the following on their home campus of the College of Saint Benedict/Saint John's University (CSB/SJU). Body fat percentage was measured using the seven site skin-fold test from the American College of Sports Medicine and a Lange Skin-fold caliper. The sites for the skin-fold measurements were as follows: triceps, subscapular, maxillary, quadriceps, abdominals, suprailiac, and pectoral.

The Alternative Healthy Eating Index—2010 was used to measure nutrition habits and was given as a survey via CSB/SJU forms manager. Traditional scoring of the Alternative Health Eating Index—2010 was not used. Rather, reported serving amount was used to examine tendencies in a few categories of food that are often neglected or over imbibed in college students including: dairy, fruit, vegetables, protein, processed grain, added sugar and alcohol. Activity habits were monitored using first generation Fitbit Charges that measure step count using an accelerometer inside the wristband. Subjects wore the Fitbit Charges for a four-day period within each testing block. They were worn from Wednesday through Saturday to measure activity during the week and on the weekend. The average step count of the eight days abroad (four days at the beginning of each semester and four days at the end of each semester) of Fitbit wearing was measured and compared to the average of the eight days of Fitbit wearing while at home.

All measurements were taken four times for each cohort over the course of the semesters – once in the beginning and once at the end of each semester. Body fat percentage was analyzed using a repeated measures ANOVA in SPSS. Nutrition habits and step counts were analyzed using independent *t*-tests in SPSS. Below is a table outlining the dates and tests conducted of the study at hand and the study done in tandem led by Kevin Curwick.

Table 1. Representation of the organization of testing blocks and measurements taken of both the current study and the study done in tandem with the current study by Curwick, Fischer, and Stenson (2017).

Testing Cohort	Abroad				Home Campus			
	Block 1		Block 2		Block 1		Block 2	
	1	2	1	2	1	2	1	2
Date	2/8-2/12	2/1-2/19	4/2-4/29	5/2-5/6	8/29-9/2	9/5-9/9	11/14-11/18	11/28-12/2
Fitbits	Y	Y	Y	Y	Y	Y	Y	Y
Skinfolds	Y	Y	Y	Y	Y	Y	Y	Y
Weight	Y	Y	Y	Y	Y	Y	Y	Y
AHEI-2010	Y	Y	Y	Y	Y	Y	Y	Y
MSPSS	Y	Y	Y	Y	Y	Y	Y	Y
HQ	Y	Y	Y	Y	Y	Y	Y	Y
SAM	Y	Y	Y	Y	N	N	N	N
RSS	N	N	N	N	Y	Y	Y	Y

Results

The purpose of this study was to examine the exercise and nutrition habits of students studying abroad in comparison to on their home campus. A 2x2 repeated measures ANOVA was conducted that examined the effect of location (abroad, on-

campus) and time (beginning of semester, end of semester) on body composition. The interaction effect between location and time was not significant, $F(1, 15) = .012, p = .913$. The main effect for location was significant, $F(1, 15) = 6.127, p = .026, \eta_p^2 = .290$, while the main effect for time was not significant, $F(1, 15) = .629, p = .440$.

A paired-samples *t*-test revealed no significant difference in physical activity abroad (10,271 \pm 2607 steps) in comparison to physical activity at home (11,622 \pm 5227 steps), $t(16) = 1.317, p = .205$.

Paired-samples *t*-tests indicated increased consumption of sugar, $t(8) = 2.501, p = .041$, increased consumption of refined grains, $t(8) = -2.898, p = .023$, and decreased consumption of fruit, $t(8) = 2.663, p = .032$, while abroad in comparison to on-campus. A repeated measures ANOVA yielded no significant effect of time on alcohol consumption $F(3, 21) = .289, p = .833$.

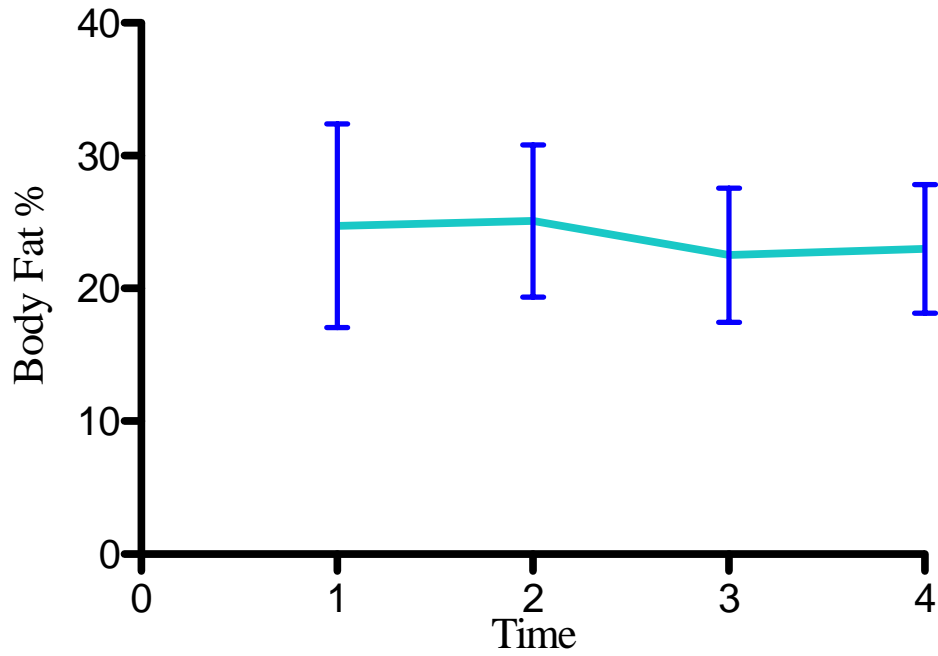


Figure 1. Body fat percentage of students at the beginning and end of abroad (1 and 2) and on-campus (3 and 4), n = 16.

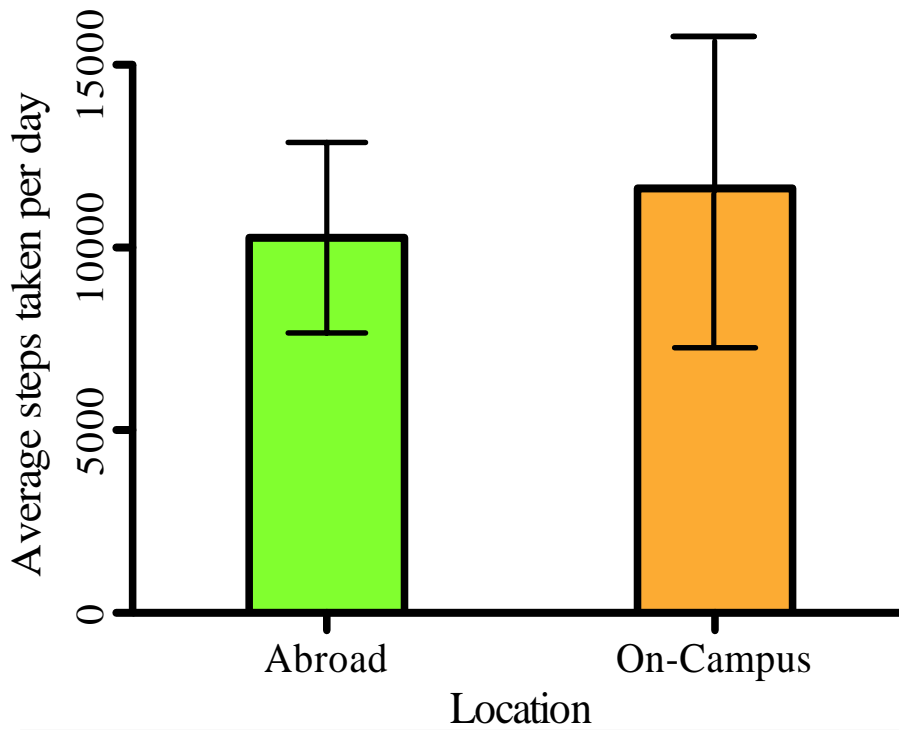


Figure 2. Average steps taken by the subjects while abroad and on-campus, n = 16.

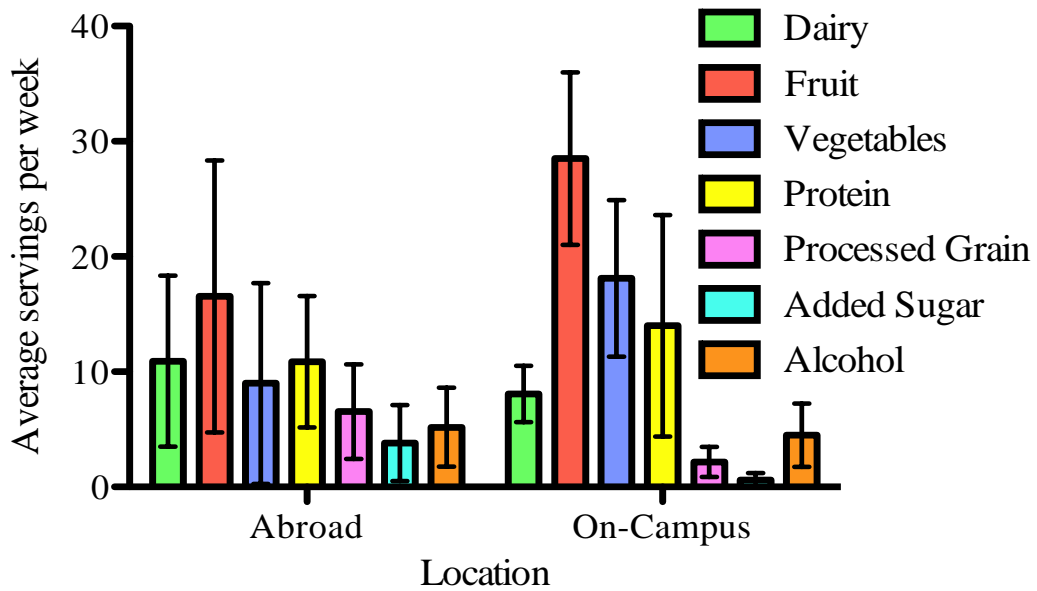


Figure 3. Measured nutritional habits of students while abroad and on-campus, n = 8.

Discussion

The purpose of this study was to analyze physical activity behaviors and dietary consumption of students while studying abroad in South Africa and on-campus at the College of Saint Benedict/Saint John's University. This analysis may provide insight into the physical health habits of students studying abroad through this program. The hypothesis, that students would be more active and have more balanced nutritional habits abroad, was not supported. Comparisons of the nutritional habits and physical activity levels were measured between the two locations. Body composition was analyzed for both location and time within the semesters themselves.

Contrary to previous research, there was no significant change in alcohol consumption when studying abroad (Pedersen, 2010; Stephenson, 1999; Wielkiewicz, 2010). This may have been due to the welcoming atmosphere of South African culture.

Curwick, Fischer, and Stenson (2017) found no significant change in homesickness or perceived social support, which may have played a role in decreasing stress experienced by the students, and transitively the lack of significant change in alcohol consumption. Throughout both abroad and home semesters students' body composition did not significantly change. With no significant change in physical activity or major fluctuations in nutrition habits there should be no change in body composition. A potential cause of the healthy nutrition habits of these students while at home is the lack of dining hall food consumed. Consistent with the findings of Papadaki, Hondros, Scott, and Kapsokefalou (2007), students living in apartment living/off-campus ate considerably less sugar and had a decreased caloric intake with increased consumption fresh fruits and vegetables compared to their counterparts living in the dorms. A potential reason for the trend towards less exercise abroad than on-campus could be simple time management of the students. Daskapan et al. (2006) and Grubbs and Carter (2002) found that the greatest reported obstacle for college students' physical activity was time management. While abroad the subjects were taking eighteen rigorous credits whilst volunteering ten hours per week at a local site on top of weekend excursions. However, on-campus, many of the subjects are fall athletes, which structures physical activity for the subjects and may contribute to the increase in activity whilst on-campus.

Multiple factors contribute to alcohol consumption abroad including location, duration, social support, sex, ethnicity, and preconceived ideas of alcohol consumption abroad (Pedersen, Cruz, LaBrie, & Hummer, 2011; Pedersen, LaBrie, & Hummer, 2009; Pedersen, LaBrie, Hummer, Larimer, & Lee, 2010; Pedersen, Larimer, & Lee, 2010; Pedersen, Neighbors, Larimer, & Lee, 2011; Pedersen, Neighbors, Lee, & Larimer, 2012;

Pedersen, Skidmore, & Aresi, 2014). As shown by Curwick, Fischer, and Stenson (2017), perceived social support did not significantly change abroad. Therefore, stable social support may play a role maintaining relatively moderate drinking habits in relation to on-campus. However, Curwick, Fischer, and Stenson (2017) utilized only eight of the subjects included in the current study. According to Pedersen, LaBrie, et al. (2010), negative alcohol habits of students involved in study abroad contributed to a rise in perceived levels of stress and weight gain. While we cannot establish cause-and-effect, evident lack of psychosocial stress on the subjects shown by Curwick, Fischer, and Stenson (2017) as well as stable drinking habits and body composition of the students may be evidence of a legitimately healthy program for undergraduate students to travel abroad on.

Many limitations accompanied the study including subject retention, accuracy of skinfold, self report of nutrition data, lack of a control group, sample size, and location. The research was completed with sixteen subjects, but the original sample consisted of nineteen. Three students chose to drop out of the study for personal reasons, which may have affected the data if they would have continued. Measurement accuracy of skinfolds and the Alternative Healthy Eating Index—2010 is a limitation of the study. Two researchers took skinfold measurements (one man and one woman) to ensure comfortability in the subjects. The AHEI—2010 can be a difficult survey to navigate for individuals with little nutrition experience. For future research the SAS US Health and Nutrition Survey should be used, as it will allow subjects to visualize portion sizes and make more accurate self-reports. Without a control group, we are incapable of telling whether or not significant world events may have played a role in increasing or decreasing

psychosocial health, which impacts physical health habits. Our sample size was small. Ideally the entire study abroad program would be utilized to gain a broader view of the students' habits. Finally, our research can only translate to study abroad programs led to Port Elizabeth, South Africa due to the variations in cultures and subcultures around the globe that may impact students' health.

Research on students' health while studying abroad is crucial for determining potential coping mechanisms or tools that may reduce the stress of acclimating to a new culture. A control group should be used in future research and the psychosocial measures of Curwick, Fischer, and Stenson (2017) should be analyzed in tandem with the exercise habits and nutritional data to observe any possible trends that may shed more light on student health abroad. Further research should also observe the physical and nutritional health effects of a study abroad in different locations and cultures. The College of Saint Benedict/Saint John's university has a total of 19 semester abroad programs on 6 different continents. The discrepancies in culture will most likely play a role in affecting student health and should be the next step in further research.

Conclusion

Studying abroad did not affect students' overall physical activity compared to studying on their home campus, but nutrition habits changed, likely due to food access and cultural norms. The change in body composition was similar during the semester abroad and at home. Students had a greater percentage body fat while abroad compared to at home, but the difference is likely due to extraneous variables. Regardless, students should be conscientious of their health while studying abroad and at home.

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