

EVALUATING STUDENT STRESS IN RELATION TO A SHORT-TERM STUDY ABROAD PROGRAM IN ANIMAL SCIENCE



Jayden L. Lawrence, Maria A. Boerngen, and Drew W. Lugar

Illinois State University

Author Note

Correspondence regarding this article should be addressed to Drew Lugar, Department of Agriculture, Illinois State University, 301 N Main St, Campus Box 5020, Normal, IL 61761. Email: dwlugar@ilstu.edu. Phone: 309-438-3881.

Abstract

While study abroad programs provide many benefits for participants, they can be very intimidating and stress-inducing for individuals that choose to participate. This study aimed to quantify student physiological and psychological stress surrounding a short-term study abroad program. By utilizing a modified Perceived Stress Survey (PSS) and a Stress Index that is derived from heart rate variability measurements, results have shown how student demographics and program adjustments can impact student stress levels. The results show that Caucasian participants had higher PSS scores than non-Caucasian participants ($P < 0.01$). Participants also had higher PSS scores prior to leaving than while abroad ($P < 0.01$). However, participants were more physiologically stressed while they were abroad than prior to leaving ($P = 0.01$). Following a change in the program's curriculum (including implementation of additional pre-departure meetings and reflections), there was also a decrease in psychological stress between participants in this study and a preliminary study conducted the year prior.

Keywords: heart rate variability, stress, animal science, study abroad

In the United States, a large percentage of agricultural workers come from Mexico and other countries located in Central America (Zahniser et al., 2018). The National Center for Farmworker Health (2022) estimates that 63% of all agricultural workers in the United States have Mexican heritage. With the present demographic of the agricultural workforce, it is important that US students have the skills and characteristics to make them successful in these changing environments. When students study abroad, they can gain experiences that are applicable to their future careers. Study abroad programs can increase leadership and communication skills, relationship building, and adaptability and flexibility in participants which are all skills applicable to future careers (Harder et al., 2015). Past studies have found that when students go abroad, they are able to gain a better understanding of diversity, which helps to bridge cultural gaps (Bruening & Frick, 2004). Short-term study abroad programs give students the opportunity to study abroad in a way that is less expensive and time consuming than traditional programs, increasing accessibility to students. There has been an increase of interest in short-term programs, according to a survey given to 527 US higher education institutions by the Institute of International Education (2023), where about 60% of students studying abroad chose programs less than 8 weeks in length.

A variety of topics related to study abroad have been studied in the past. However, student mental health, specifically student stress while abroad, has not been commonly investigated. Bathke and Kim (2016) examined student mental health while abroad over different programs. The participant demographics in their trips were a majority female, and a majority of the trips were approximately a semester long, but also included programs that were over the

summer, short-term, and yearlong. Bathke and Kim (2016) found that 40.78% of study abroad participants almost never felt stressed, 44.05% reported being stressed sometimes, and 14.85% reported often or always being stressed while abroad. Hunley (2010) evaluated psychological stress and loneliness while studying abroad in a semester-long program. That study found that participants had higher psychological stress levels while they were abroad than while they were at home (Hunley, 2009).

One consideration in designing a study abroad program is the period of time preparing the students to go abroad. Jones and Bjelland (2004, p. 963) discussed the idea of prelection, which they define as “the process of being consciously aware of the expectations associated with the learning experience”. This prelection period increases participants’ capacity to learn from the experiences abroad and allows them to become better prepared for the variety of knowledge that comes with going abroad (Jones & Bjelland, 2004; Roberts et al., 2013). Prelection also allows students to become familiar with the other trip participants prior to being abroad (Koernig, 2007). According to Roberts et al. (2013), educators should ensure that students understand the details of the upcoming experience, as well as the applicability of the trip to help reduce anxiety and stress, while also increasing excitement and focus. Some suggestions for the period prior to leaving include pre-sessions geared towards topics of concern and safety, giving students an overview of cultural practices, and topics geared towards emotional and physical needs of the learners (Roberts et al., 2013).

Psychological stress in both college students and people of all ages can be measured via the Perceived Stress Scale (PSS; Cohen et al., 1983). The PSS is a Likert-Scale survey that consists of 10 questions and has long been utilized in different environments to determine psychological stress (Andreou et al., 2011; Anwer et al., 2020; Roberti et al., 2006). Scores of the PSS have been divided into three different categories of severity. These categories include scores between 0-13 which is considered mild stress, 14-26 which is considered moderate stress, and 27-40 which is considered severe stress (Graves et al., 2021). Örüçü & Demir (2009) reported an average score of 18.9 in college-aged students, with a standard deviation of 6.8, which supports the idea that college aged students score within the moderate stress category (Graves et al., 2021).

Additionally, stress can be quantified with physiological measures such as heart rate variability (HRV), which is the change of the time intervals between adjacent heartbeats (Shaffer & Ginsberg, 2017). Heart rate variability has been shown to serve as a measure of physiological stress in a variety of studies in different populations (Dishman et al., 2000; Orsila, 2008; Taelman, 2009), and is inversely proportional with stress, where a lower HRV is reflective of increased stress (Kim et al., 2018). One method of utilizing HRV as an indicator of stress is through the Baevsky Stress Index (SI), a directly proportion indicator of stress. The SI is calculated using the equation shown in Figure 1 (Baevsky, 2019). Generally, the SI is reported as the square root of the calculated value to ensure normal distribution for statistical analysis (Dias et al., 2022). Scores of the SI can be divided

into different zones of stress severity, where SI scores less than 7.1 are considered low, 7.1-12.2 considered normal, 12.2-22.4 considered elevated, 22.4-30 considered high and greater than 30 considered very high (Tarvainen et al., 2018). The SI attempts to “describe the degree of centrally managed sympathetic regulation of mental or physical stress” (Walker, 2019, p. 42). The sympathetic nervous system, which is active when the body is under stressful conditions, is linked highly to the SI, which in turn links the SI to physiological stress (Walker, 2019).

Figure 1

Stress Index Formula

$$SI = \frac{AMo * 100\%}{2Mo * MxDMn}$$

Note. Formula utilized to calculate the Baevsky Stress Index. All values included are calculated from Heart Rate Variability metrics, where AMo is the mode amplitude, Mo is the mode interbeat interval, and MxDMN is the variation scope that reflects the degree of interval variability (Baevsky, 2019).

This study had two goals. The first was to continue the examination of physiological and psychological stress in students in Animal Science study abroad programs from a previous study initially completed by Lawrence et al. (2024). This program focuses on animal agriculture in Mexico due to the demographics of the US agricultural workforce in order to prepare students for future careers in animal agriculture. The second was to determine if curricular adjustments made by the program coordinator to reduce stress made a difference in the psychological and physiological stress levels of students.

Methods

This study is an adapted version of a preliminary study completed by Lawrence et al. (2024). The present study was conducted in January 2024 during a 10-day Animal Science study abroad program located in the Yucatan state of Mexico. This program was hosted by the Department of Agriculture at Illinois State University. The program included cultural excursions around the state and trips to local producers’ livestock operations. Students were invited to participate in the study in the first meeting prior to going abroad, and consent and demographic surveys were collected. The program coordinator had no access to the names of students that were participating in the study or their data until all data was de-identified after completion of the program. All study procedures were approved by the Illinois State University Institutional Review Board, (Protocol #2022-172).

Study Participants

A summary of participant demographics is included in Table 1. There were 12 total participants majoring in Animal Science or Pre-Veterinary Medicine, 10 of whom were female. The ages of participants ranged from 19 to 26 years, with an average of 21.5 years. Seven of the participants identified as Caucasian, and five identified as non-Caucasian ethnicities. Non-Caucasian ethnicities were aggregated to ensure participant confidentiality and avoid any possibility of individual identification. The academic years ranged from sophomore to seniors. Participant prior experience abroad varied and were divided into two groups: those that had been abroad less than two times ($n = 8$), and those that had been abroad two or more times prior to this program ($n = 4$). Spanish language comprehension was based on participant self-ranking, with 8 individuals who identified that they knew some Spanish and ranked themselves in the minor category, and 4 individuals who identified that they had a complete comprehension of Spanish and ranked themselves in the major category.

Table 1
Participant Demographics

Characteristic	# of Participants	% of Participants
Sex		
Male	2	16.7
Female	10	83.3
Ethnicity		
Caucasian	7	58
Non-Caucasian	5	42
Prior Abroad Experience		
< 2 time	8	66.6
≥ 2 times	4	33.4
Spanish Comprehension		
Minor	8	66.6
Major	4	33.4

Study Design and Implementation

Data for this study were collected in two phases: prior to going abroad (PRE) and while abroad (ABRD) and were directly connected to each individual participant to account for individual differences in stress in the PRE and ABRD phases. The data collected in the PRE phase took place once every three weeks between September 28th and December 8th, 2023. Participants were asked to schedule a time with the graduate student. All study measurements were collected in the mornings between the hours of 0800 and 1000, in an on-campus office by the graduate student on the research team. Measurements that took place in the ABRD phase took place in the participant’s hotel room

shortly after waking up each morning while abroad. The metrics that were measured in both time periods included physiological and psychological stress. Psychological stress was measured with a modified version of the PSS, a Likert type survey consisting of 10 questions with scores for each question ranging from 0-4 (Cohen et al. 1983). The scale was changed from the original PSS in that “*in the past month*” was changed to “*in the past 24 hours*” (figure 2), which is the same adjustment that was utilized by Lawrence et al. (2024). To score these surveys, there were 6 positive questions (questions 1, 2, 3, 6, 9, and 10) that were added directly, and there were 4 negative questions (4, 5, 7, and 8) that were “reversed.” After this, the number was added to the overall score. For example, in the negative questions, if the participant scored it as a 0, it would be added to the overall score as a 4. The overall scores of this survey can vary from a high of 40, to a low of 0. The PSS was provided to students in hard copy form. In the PRE phase, students completed their PSS during data collection meetings with the graduate student. In the ABRD phase, students completed their PSS in their hotel rooms or at breakfast.

Physiological stress was measured through HRV with the smart phone application Kubios HRV version 2.2 software (Kubios, Finland) that connected to chest straps (Polar H9, Polar Electro, Kempele, Finland). The chest straps were moistened with water and placed on the lower sternum. Participants were then asked to sit and complete the PSS to allow their heart rate to fall to a resting rate. After this, their chest straps were connected to their phones via Bluetooth and they completed a three-minute HRV test. From the HRV data, the Baevsky Stress Index (SI) was used to indicate physiological stress. Data were then given to the research team and were de-identified and entered into an excel spreadsheet. In the PRE phase, the graduate student trained students how to utilize the heart rate monitor strap. Participants were given their own straps for the ABRD phase to ensure their measurements were taken soon after waking up. Participants were advised, and reminded to complete the measurements and communicate their findings to the graduate student.

Preflection Addition and Curriculum Adjustments

In both programs, students enrolled in a “Special Topics in Agriculture” course for a semester, the predeparture meetings took place throughout the semester and the abroad portion took place during winter break. Preflections, and additional pre-study abroad meetings were added to the latter study abroad curriculum. The initial program had 3 pre-departure meetings, one in September, one in November, and one in December. These meetings were purely informational sessions including a summary of the program details and open discussion about questions or concerns.

The second program had additional required, predeparture meetings with a total of five in-person and a single online meeting. These included in person meetings in August, September, two in October, and November and a single online meeting in December. These meetings

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Figure 2

Modified Perceived Stress Survey

1.) In the past 24 hours, how often have you been upset because of something that happened unexpectedly?
2.) In the past 24 hours how often have you felt that you were unable to control the important things in your life?
3.) In the past 24 hours, how often have you felt nervous and stressed?
4.) In the past 24 hours, how often have you felt confident about your ability to handle your personal problems?
5.) In the past 24 hours, how often have you felt that things were going your way?
6.) In the past 24 hours, how often have you found that you could not cope with all the things that you had to do?
7.) In the past 24 hours, how often have you been able to control irritations in your life?
8.) In the past 24 hours, how often have you felt that you were on top of things?
9.) In the past 24 hours, how often have you been angered because of things that happened that were outside of your control?
10.) In the past 24 hours, how often have you felt difficulties were piling up so high that you could not overcome them?

Note: Modified perceived stress survey from Cohen et al., (1983), as previously described by Lawrence et al. (2024).

consisted of information on agriculture in Mexico, culture, preparations for going abroad, and expectations prior to going abroad. The meeting formats included a general update of program details, a lecture, followed by time for open questions and discussion and occasional food or activities related to Mexican culture (i.e. eating marquesitas or painting sugar skulls). The adjustments to the second program included the addition of prelections, as well. After each predeparture meeting, students were asked to submit responses to three, guiding questions approximately 24 hours after the meeting took place: *“Based on our meeting today, what is one thing you learned? Are you nervous about going abroad? If so, what are you most nervous about? What are you most excited to see/do abroad?”* A total of five prelection journals were assigned in this program, one for each of the in-person, predeparture meetings. These questions were intended to stimulate thought by the students regarding going abroad and the content being discussed.

Statistical Analysis

The data were analyzed using the mixed procedure of SAS (version 9.4; Cary, NC 27513), and statistical significance was determined when $P \leq 0.05$. Two separate models were utilized: one with PSS score as the dependent variable, and the other with the SI. The independent variables included ethnicity, time period, abroad experience, and level of Spanish language comprehension. A repeated measures statement was included by day with the participant as the subject. The assumptions were tested with residual panels for homogeneity of variance and normality of residuals.

Additional analyses were completed using the preliminary results from Lawrence et al. (2024) in combination with the

results of the present study. This model utilized PSS as the dependent variable with trial (preliminary and present study), period (PRE and ABRD), and their interaction as the independent variables. A repeated measurement was included by measurement with participant as the subject. All assumptions were tested with the residual panels for homogeneity of variance and normality of residuals.

Results

Summary statistics of the data are included in Table 2. The average SI score was 12.9 ± 6.3 (average \pm standard deviation). The minimum SI was 1.43 with a maximum of 43.9. The average PSS score was 10.9 ± 6.1 with a minimum score of 0 and a maximum score of 28.

Table 2

Summary Statistics of Stress Index and Perceived Stress Surveys

Variable	N	Mean	Standard Deviation	Minimum	Maximum
SI	154	12.9	6.3	1.43	43.9
PSS	156	10.9	6.1	0	28.0

Note. Overall summary statistics for participant Stress Index (SI) and Perceived Stress Scores (PSS) over a short-term study abroad program

The PSS results are summarized in Table 3. The main effect of ethnicity showed that Caucasian participants (15.3 ± 1.1 ; LS mean \pm SE) had higher PSS scores than non-Caucasian participants (8.3 ± 1.1 ; $P < 0.01$). Participant study abroad experience and Spanish language

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Table 3

Study abroad and demographics on student perceived stress scores

Variable	Coefficient	Standard Error	P-Value
Ethnicity			
Caucasian	15.3	1.1	<0.01
Non-Caucasian	8.3		
Abroad Experience			
< 2 times	11.8	1.1	0.96
≥ 2 times	11.8		
Spanish Comprehension			
Minor	13.0	1.1	0.13
Major	10.6		
Phase			
PRE	14.4	0.9	<0.01
ABRD	9.2		

Note. Abroad experience consisted of two categories, those that had been abroad twice or more, (≥ 2 times) and those that had been abroad once, or not at all (<2 times). Spanish Comprehension was based off participant ranking of their Spanish-speaking knowledge and categorized as minor comprehension or major comprehension. Phase consisted of measurements prior to departure (PRE: 5 measurements taken in the semester prior to going abroad, taken every third week of the fall semester) and while abroad (ABRD; days 1-10). Statistical significance was determined when ($P < 0.05$).

comprehension level did not have an impact on PSS scores ($P \geq 0.13$). Results from the time period of measurements showed participants had higher PSS prior to leaving (14.4 ± 1.0) than while they were abroad (9.2 ± 0.8 ; $P < 0.01$).

The SI results are summarized in Table 4. There were no differences in ethnicities, or participant Spanish language comprehension level on SI values ($P \geq 0.12$). Participant prior experience abroad for SI was greater when participants had been abroad two or more times (15.3 ± 1.2) than those that had less prior experience (11.5 ± 0.9 ; $P = 0.03$). The time period of when measurements were taken showed that participants had higher SI values while abroad (14.9 ± 0.8) than prior to leaving (11.9 ± 1.0 ; $P = 0.02$).

The combined PSS results from the present study and preliminary study are included in Table 5. There was a difference between trials where the preliminary trial had an overall higher PSS (18.9 ± 1.2) than the present study (12.2 ± 0.9 ; $P < 0.01$). There was also an overall difference between periods where the PRE period had a higher PSS (19.8 ± 0.9) than the ABRD period (11.2 ± 0.7 ; $P < 0.001$). The interaction of period and trial tended to differ ($P = 0.06$; figure 3) where the PSS score while ABRD in the preliminary trial (13.7 ± 1.1) was higher than the ABRD score in the present trial (8.8 ± 1.0 ; $P = 0.02$). The PRE period of the preliminary trial (24.1 ± 1.5) was greater than the PRE period of the present trial (15.5 ± 1.1 ; $P < 0.001$). The PRE period of both trials were greater than the ABRD period in their respective trials ($P < 0.001$).

Table 4

Study abroad and demographics on student stress index

Variable	Coefficient	Standard Error	P-Value
Ethnicity			
Caucasian	12.0	1.1	0.12
Non-Caucasian	14.7		
Abroad Experience			
< 2 times	11.5	1.2	0.03
≥ 2 times	15.3		
Spanish Comprehension			
Minor	13.8	1.2	0.06
Major	12.9		
Phase			
PRE	11.9	1	0.02
ABRD	14.9		

Note. Abroad experience consisted of two categories, those that had been abroad twice or more, (≥ 2 times) and those that had been abroad once, or not at all (<2 times). Spanish Comprehension was based on participant ranking of their Spanish-speaking knowledge. Phase consisted of measurements prior to departure (PRE: 5 measurements taken in the semester prior to going abroad, taken every third week of the fall semester) and while abroad (ABRD; days 1-10). Statistical significance was determined when ($P < 0.05$).

Table 5

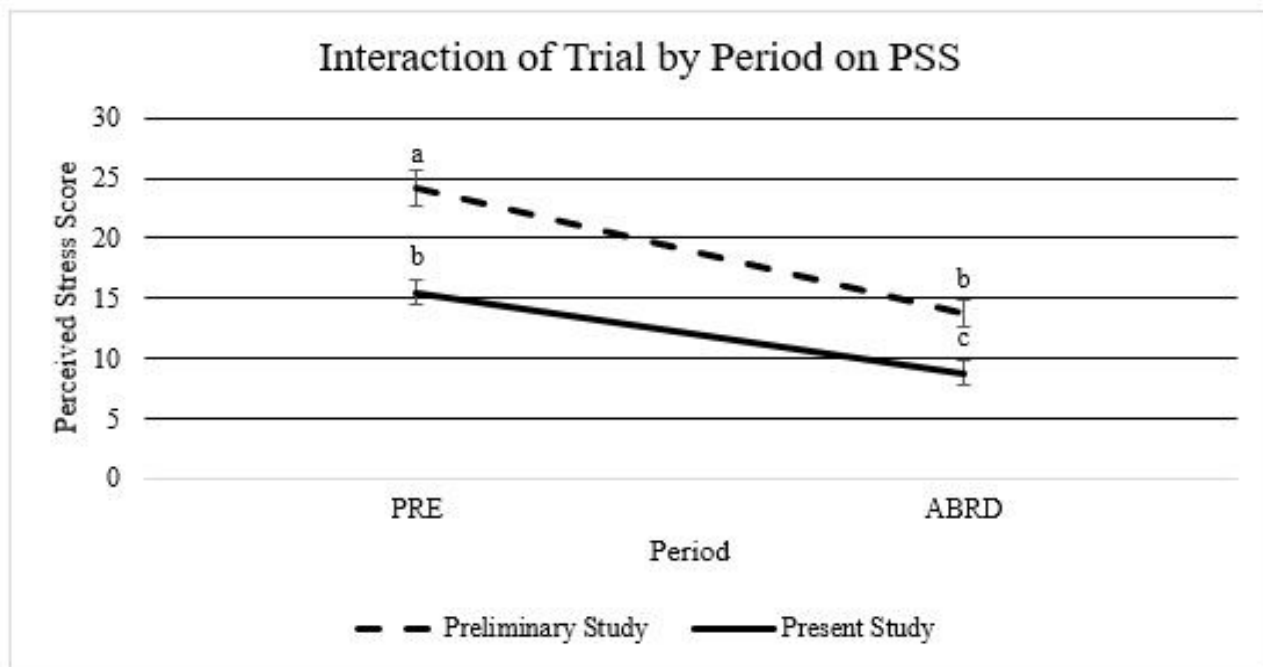
Trial and time period on student perceived stress

Variable	LS Means	Standard Error	P-Value
Trial			
Preliminary	18.9	1.2	<0.001
Present	12.2	0.9	
Period			
PRE	19.8	0.9	<0.001
ABRD	11.2	0.7	

Note. Trial consisted of two repetitions, Preliminary (Lawrence et al., 2024) took place in December 2022, and Present, the present study took place in January 2024. Period consisted of the time period leading up to going abroad (PRE) and measurements taken while abroad (ABRD). Statistical significance was determined when ($P < 0.05$).

Figure 3

Interaction of trial and time period on student perceived stress



Note. This figure illustrates the interaction effect of trial by period on participant perceived stress ($P = 0.04$). The trials include the preliminary study, completed by Lawrence et al., (2024) in December 2022 and the present study. Period includes PRE, which were measurements taken prior to going abroad, and ABRD which were measurements taken while participants were in Mexico studying abroad. abc Letters that differ are statistically different from one another ($P < 0.05$).

Discussion

Perceived Stress Surveys are long utilized in the quantification of psychological stress. It is important to note that for this study, the time period was changed from “in the last month” to “in the last 24 hours”. While the questions being asked are the same, the time period is different from the original publication written by Cohen et al. (1983), however this modification has been previously utilized (Lawrence et al., 2024). Generally, PSS scores are categorized into three divisions: mild which is a score from 0-13, moderate which is a score from 14-26, and severe which is a score from 27-40 (Graves et al., 2021). The overall average of the present study, average score while abroad, both categories of abroad experience, both major and minor levels of Spanish comprehension, and non-Caucasian participant average scores all fall into the mild category. All of these are also less than the average of 14.2 reported for individuals aged 18-29 throughout the United States, and the “student” average of 15.3, reported by Cohen and Williamson (1988). In the preliminary study, the overall average would be classified within the moderate stress category (Lawrence et al., 2024). With the additions of the prelections prior to going abroad in the present study, the overall average PSS score of the current study may show that these meetings and assignments were effective in their goal of reducing psychological stress related to study abroad.

The PSS results of the present study could be partially explained by the idea of anticipatory stress. Anticipatory stress is the concept that in the time period preparing for

a difficult task an individual shows higher stress than they do while completing the task itself (Nasso et al., 2019). Anticipatory stress is crucial because it causes individuals to develop coping strategies so that there are appropriate behavioral adjustments in response to the actual stressor (Schlatter et al., 2021). In terms of study abroad, the participants are likely anticipating the events and stressors of the trip. While they are abroad, they are able to cope with the stressors of the program due to their stress prior to leaving, thereby resulting in reduced psychological stress while abroad.

In the present study, non-Caucasian participants had lower PSS scores than Caucasian participants. It has been previously reported that individuals that identify as African American have lower lifetime rates of major depression in comparison to Caucasian counterparts, however, there is not a current sense of the level of mental health status within major ethnic groups in the United States (Williams, 2018). Cohen and Williamson (1988) reported contradictory results to the present study, showing Caucasian participants had the lowest average score, followed by Hispanic, African American, and other minority ethnicities. In the present study, Caucasian participants had PSS scores in the moderate stress category, whereas non-Caucasian participants’ scores were in the mild category. In the present study, Caucasian participants’ average score was higher than what was reported by Cohen and Williamson (1988).

The Baevsky Stress Index, as a reflection of the sympathetic nervous system, increases as an individual

becomes more stressed. According to Tarvainen et al. (2018), the Stress Index is divided into different stress zones. For the present study, the values fell within the normal, and elevated stress zones. The participant demographic categories that fell within the normal stress zone included Caucasian participants, those that have been abroad greater than twice prior to the study abroad trip, and participants' scores within the PRE phase (Table 4). All other variable categories fell within the elevated stress category, including non-Caucasian participants, participants that had been abroad less than two times, and measurements taken within the abroad phase (Table 4). While abroad, some activities that were completed were potentially physically taxing for some students including walking for long periods of time, riding bicycles, and standing for long durations in elevated temperatures. This may partially explain why some participants saw a difference in their physiological stress levels, especially if participants did not exercise regularly prior to leaving.

For the present study, the results of the physiological and psychological stress measures showed contradictory results. Anecdotally individuals would expect that physiological and psychological stress would follow a similar trend. Epel et al. (2018), stated that the association between self-reported stress scores, especially in Likert-type scaling, generally have a weaker connection to biological, or physical stress. With the use of the PSS, this explanation could serve as a possible reason for the contradiction found in the present study between physiological and psychological stress. Additionally, participants were in a more physically demanding environment than when at in the university setting with a lot of walking, in elevated ambient temperatures. The physical fitness levels of the student may have been stressed while abroad, which may also serve as a possible explanation, although physical fitness was not measured in the present study.

Overall, there is little literature on student stress while studying abroad. The goal of the present study, as well as the preliminary study, was to evaluate student stress while abroad in short term study abroad programs. One study, written by Hunley (2009), evaluated psychological stress in students studying abroad in Rome. They found that students experienced more psychological distress and loneliness while they were abroad than they did prior to departure. An additional study written by Bathke and Kim (2016) found similar results, where students had an increase of loneliness while they were abroad in comparison to while they were home. These studies are contradictory to the present study. This could be due to the difference in the methodologies, both of the studies mentioned took fewer measurements prior to going abroad than the present study. It could also be due to the differing lengths in the programs studied which included semester, year, summer, and short term for Bathke and Kim (2016), a 14-week trip in the study completed by Hunley (2009), and 10 days in the present study. However, Maultsby and Stutts (2019) found similar results to the present study where students were less stressed and reported less depression abroad. This study by Maultsby and Stutts (2019) was longitudinal, across multiple study abroad programs, where aggregated results were reported.

In designing a study abroad program, one of the most significant time periods to plan is the period leading up to students leaving to go abroad. Past research has concluded that reflection provides the bridge between "thinking about an experience and actually learning from the experience" (Jones and Bjellan, 2004, p. 963). After the first program was completed (Lawrence et al., 2024), the program director implemented reflection journals into the course and integrated them into the pre-departure meetings that took place prior to leaving. These prompts encouraged students to think more about the material they were learning, how they were going to apply it, and how they felt in terms of being prepared for going abroad. Reflection journals are a long-utilized method in study abroad programs (Klein, 2012; Roberts et al., 2013; Wingenbach et al., 2006). With the reflections, the program coordinator also included additional meetings prior to leaving that included more information on the itinerary and expectations of the trip, as well as team building activities to help promote a more positive learning community while abroad (Lutterman-Aguilar & Gingerich, 2015). The reflection meetings may have been partially responsible for the decrease in the PSS scores that were seen between the preliminary and present trials. In the first program, there were fewer meetings with no reflections and limited team building, and the PSS scores were significantly higher. The reflections also allowed the program coordinator to gain awareness of concerns that participants had, and to modify the program to best fit their needs.

Summary

In summary, participants had an overall higher perceived, or psychological stress prior to leaving than while they were abroad. Ethnicity also had an impact on psychological stress scores, where Caucasian participants had a higher stress level than non-Caucasian participants. These results were the same as what was found in a preliminary study. There was also a significant decrease in perceived stress between the preliminary and the present study, likely due to the addition of reflections in the curriculum. For participant physiological stress, participants that had more abroad experience were more stressed than those who did not. Participants were also more physiologically stressed abroad, than they were in the period prior to leaving. Limitations for this study include a small sample size, as well as unbalanced demographics. Future research is needed on student stress in study abroad programs with additional measures of physiological stress.

References

- Andreou, E., Alexopoulos, E. C., Lionis, C., Varvogli, L., Gnardellis, C., Chrousos, G. P., & Darviri, C. (2011). Perceived Stress Scale: Reliability and Validity Study in Greece. *International Journal of Environmental Research and Public Health*, 8(8), Article 8. <https://doi.org/10.3390/ijerph8083287>
- Anwer, S., Manzar, M. D., Alghadir, A. H., Salahuddin, M., & Abdul Hameed, U. (2020). Psychometric Analysis of the Perceived Stress Scale Among Healthy University Students. *Neuropsychiatric disease and treatment*, 16, 2389–2396. <https://doi.org/10.2147/NDT.S268582>
- Baevsky, R. M., & Berseneva, A. P. (2008). *Methodical recommendations use kardivar system for determination of the stress level and estimation of the body adaptability standards of measurements and physiological interpretation*. Methodical-recommendations-USE-KARDiVAR-SYSTEM-FOR/74a292bfafca4fdf1149d557348800fcc1b0f33b.
- Bathke, A., & Kim, Y.-H. (2016). Keep calm and study abroad: The effect of learning abroad on Student Mental Health. *Frontiers: The Interdisciplinary Journal of Study Abroad*, 27(1), 1–16. <https://doi.org/10.36366/frontiers.v27i1.371>
- Bruening, T. H., & Frick, M. (2004b). Globalizing the U.S. undergraduate experience: A case study of the benefits of an international agriculture field-based course. *Journal of International Agricultural and Extension Education*, 11(1), 89–96.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396. <https://doi.org/10.2307/2136404>
- Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Eds.), *The social psychology of health: Claremont symposium on applied social psychology*. Newbury Park, CA: Sage.
- Dias, C. J., Barroso, R., Dias-Filho, C. A. A., Ferreira, A. C., Cabido, C. E. T., Crestani, C. C., Silva, M. S., Pinheiro, A. N., Rodrigues, B., & Mostarda, C. T. (2022). Possible influences of vitamin D levels on sleep quality, depression, anxiety, and physiological stress in patients with chronic obstructive pulmonary disease: a case control study. *Sleep science (Sao Paulo, Brazil)*, 15(Spec 2), 369–374. <https://doi.org/10.5935/1984-0063.20210019>
- Dishman, R. K., Nakamura, Y., Garcia, M. E., Thompson, R. W., Dunn, A. L., & Blair, S. N. (2000). Heart rate variability, trait anxiety, and perceived stress among physically fit men and women. *International journal of psychophysiology: official journal of the International Organization of Psychophysiology*, 37(2), 121–133. [https://doi.org/10.1016/s0167-8760\(00\)00085-4](https://doi.org/10.1016/s0167-8760(00)00085-4)
- Epel, E. S., Crosswell, A. D., Mayer, S. E., Prather, A. A., Slavich, G. M., Puterman, E., & Mendes, W. B. (2018). More than a feeling: A unified view of stress measurement for population science. *Frontiers in neuroendocrinology*, 49, 146–169. <https://doi.org/10.1016/j.yfrne.2018.03.001>
- Facts about agricultural workers fact sheet*. NATIONAL CENTER FOR FARMWORKER HEALTH. (2022). <https://www.ncfh.org/facts-about-agricultural-workers-fact-sheet.html>
- Graves, B. S., Hall, M. E., Dias-Karch, C., Haischer, M. H., & Apter, C. (2021). Gender differences in perceived stress and coping among college students. *PLOS ONE*, 16(8). <https://doi.org/10.1371/journal.pone.0255634>
- Harder, A., Andenoro, A., Roberts, T. G., Stedman, N., Newberry, M., Parker, S. J., & Parker, M. T. (n.d.). Does Study Abroad Increase Employability? *NACTA Journal*, 59(1), 41–48.
- Hunley, H. A. (2010). Students' functioning while studying abroad: The impact of psychological distress and loneliness. *International Journal of Intercultural Relations*, 34(4), 386–392. <https://doi.org/10.1016/j.ijintrel.2009.08.005>
- Institute of International Education. (2023). "Profile of U.S. Study Abroad Students, 2000/01-2021/22." *Open Doors Report on International Education Exchange*.
- Jones, B.L. and D. Bjelland. 2004. International experiential learning in agriculture. *AIAEE 2004: Proc. of the 20th Annual Conference*, 20, 963-964.
- Kim, H. G., Cheon, E. J., Bai, D. S., Lee, Y. H., & Koo, B. H. (2018). Stress and Heart Rate Variability: A Meta-Analysis and Review of the Literature. *Psychiatry investigation*, 15(3), 235–245. <https://doi.org/10.30773/pi.2017.08.17>
- Klein, C. (2012). *The Phenomenon of Combining Service Learning and Study Abroad: A Qualitative Inquiry* (Dissertation, Texas Tech University).
- Koernig, S. K. (2007). Planning, organizing, and conducting a 2-week study abroad trip for undergraduate students: Guidelines for first-time faculty. *Journal of Marketing Education*, 29(3), 210–217. <https://doi.org/10.1177/0273475307306886>
- Kubios_HRV_Users_Guide.pdf. (2018). Retrieved from https://www.kubios.com/downloads/Kubios_HRV_Users_Guide.pdf
- Lawrence, J., Barrowclough, M., & Lugar, D. (2024). Study Abroad Programs and Student Stress: An Animal Science Curriculum Case Study. *NACTA Journal*, 68(1). <https://doi.org/10.56103/nactaj.v68i1.169>

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- Lutterman-Aguilar, A., & Gingerich, O. (2015). Experiential pedagogy for study abroad: Educating for global citizenship. *Frontiers: The Interdisciplinary Journal of Study Abroad*, 8, 41-82.
- Maultsby, K. D., & Stutts, L. A. (2019). A longitudinal examination of study abroad: Student characteristics and psychological health associations. *College Student Affairs Journal*, 37(2), 184–199. <https://doi.org/10.1353/csj.2019.0014>
- Nasso, S., Vanderhasselt, M. A., Demeyer, I., & De Raedt, R. (2019). Autonomic Regulation in Response to Stress: The Influence of Anticipatory Emotion Regulation Strategies and Trait Rumination. *American Psychological Association* 19(3), 443-454. <http://dx.doi.org/10.1037/emo0000448>
- Orsila, R., Virtanen, M., Luukkaala, T., Tarvainen, M., Karjalainen, P., Viik, J., Savinainen, M., & Nygård, C. H. (2008). Perceived mental stress and reactions in heart rate variability--a pilot study among employees of an electronics company. *International journal of occupational safety and ergonomics: JOSE*, 14(3), 275–283. <https://doi.org/10.1080/10803548.2008.11076767>
- Örücü, M. Ç., & Demir, A. (2009). Psychometric evaluation of Perceived Stress Scale for Turkish University students. *Stress and Health*, 25(1), 103–109. <https://doi.org/10.1002/smi.1218>
- Roberti, J. W., Harrington, L. N., & Storch, E. A. (2006). Further psychometric support for the 10-item version of the perceived stress scale. *Journal of Counseling Association*, 9, 135e147
- Roberts, T. G., Conner, N. W., & Jones, B. L. (2013). An Experiential Learning Framework for Engaging Learners During Study Abroad Experiences. *NACTA Journal*, 57(3a), 28–35. <http://www.jstor.org/stable/nactajournal.57.3a.28>
- Schlatter, S., Schmidt, L., Lilot, M., Guillot, A., & Debarnot, U. (2021). Implementing biofeedback as a proactive coping strategy: Psychological and physiological effects on anticipatory stress. *Behaviour Research and Therapy*, 140, 103834. <https://doi.org/10.1016/j.brat.2021.103834>
- Shaffer, F., & Ginsberg, J. P. (2017). An Overview of Heart Rate Variability Metrics and Norms. *Frontiers in public health*, 5, 258. <https://doi.org/10.3389/fpubh.2017.00258>
- Taelman, J., Vandeput, S., Spaepen, A., & Van Huffel, S. (2009). *Influence of Mental Stress on Heart Rate and Heart Rate Variability*. In J. Vander Sloten, P. Verdonck, M. Nyssen, & J. Haueisen (Eds.), *4th European Conference of the International Federation for Medical and Biological Engineering* (pp. 1366–1369). Springer. https://doi.org/10.1007/978-3-540-89208-3_324
- Tarvainen, M. P., Lipponen, J. A., Niskanen, J. P., & Ranta-Aho, P. O. (2018). *User's Guide*. https://www.kubios.com/downloads/Kubios_HRV_Users_Guide.pdf
- Walker, L. A. (2019). *Environmental recordings of normal adults' heart rate for five consecutive days during all waking hours* (dissertation).
- Williams D. R. (2018). Stress and the Mental Health of Populations of Color: Advancing Our Understanding of Race-related Stressors. *Journal of health and social behavior*, 59(4), 466–485. <https://doi.org/10.1177/0022146518814251>
- Wingenbach, G., Chmielewski, N., Smith, J., Pina Jr., M., & Hamilton, W. (2006). Barriers to international experiential participation. *Journal of International Agricultural and Extension Education*, 13(3). <https://doi.org/10.5191/jiaee.2006.13306>
- Zahniser, S., Taylor, J. E., Hertz, T., & Carlton, D. (2018, November). *Farm Labor Markets in the United States and Mexico pose challenges for U.S. agriculture*. USDA ERS. <https://www.ers.usda.gov/publications/pub-details/?pubid=90831>