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INTERNATIONAL STUDENTS' DIETARY HABITS, PHYSICAL ACTIVITY AND BMI CHANGE DURING THEIR FIRST YEAR OF RELOCATING TO THE U.S.

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ABSTRACT

Objective: this study aims to identify dietary patterns, physical activity and BMI changes after relocation among international students attending two large urban universities, one public and one private in the southeast of the U.S.

Methods: seventy-five international students answered a food frequency questionnaire (FFQ), physical activity table, screen-time and sleep duration questions at baseline (within 10 days of their arrival to the U.S.) and at follow-up (after 3 to 6 months of relocation). Body weight, height and waist circumference were measured at both time points. SAS 9.4 was used to analyze the data and produce descriptive results.

Results: participants (65.3% females and 34.7% males) reported decreased consumption of dairy products and grains after 3 to 6 months relocation (from 4.8 to 3.7 times/week, p-value 0.01 and from 4.8 to 4.5 times/week, p-value 0.006 respectively). There was no statistically significant change in physical activity or BMI among participants after relocation. Thirty-three percent of students gained weight after relocation, while 43% lost weight and 24% maintained their baseline weight. Forty-eight percent of participants had <5% weight changes after relocation. Twenty-one percent of participants gained ≥5% and 6.6% lost ≥5% of their weight. The percentage of students that perceived an increase in their weight after relocation, was 1.4 times the percentage of students who actually gained weight (65% vs. 33%). On the other hand, only 21% of students perceived losing weight while 43% showed measured weight loss. Screen-time significantly increased from 4.2 hours/day at baseline to 7.0 hours/day at follow-up (p-value <0.001). Perceived deterioration in overall health was a concern reported by 73% of the participants due to increased stress and decreased immunity.

Conclusion: these findings emphasize the need to objectively measure changes in body weight as done in the study, because the perception of weight change among international students may not be reflective of true change in their anthropometric measurements. A significant increase in screen-time exposure (p-value<0.001) and reported stress, require further investigation to measure their effects on overall health status among international students.

I. INRODUCTION

International students make up 5.5% of the total U.S. higher education population. In 2018, this included over 1 million students (Morris, 2018). The state of Georgia alone hosted 23,623 students from around the world in the academic year of 2018-2019 (Williams, 2019). International students face various challenges during their shift to a new country (Skromanis et al., 2018; Wu, Garza, & Guzman, 2015). Language barriers, homesickness, accommodation difficulties, learning style differences, financial problems and a cultural shift are some of these challenges that may affect international students' health status and the types of foods and beverages they are consuming (Wu et al., 2015).

International students' relocation offers a unique opportunity to study changes in dietary habits, physical activity and body weight that are often related to their recent migration. As international students adapt to the host country's food system, dietary behaviors may modify according to the availability and accessibility of certain foods (Almohanna, Conforti, Eigel, & Barbeau, 2015). Additional factors that influence dietary habits among college aged students (18-24-year-old) includes convenience and campus environment (Alakaam & Willyard, 2020). International students reported these factors as possible reasons for their increased consumption of fast food as such items are conveniently faster to prepare, lower in price and readily available around them (Alakaam, Castellanos, Bodzio, & Harrison, 2015; Alakaam & Willyard, 2020; Leu & Banwell, 2015). Several negative health outcomes have been associated with modified diet after migration and compared with diet at home countries (e.g., increased consumption of fast food) among international students and other foreign-born individuals in the United States and Europe; these outcomes include weight gain and increased levels of glucose, cholesterol and blood pressure (Alakaam et al., 2015; Alakaam &

Willyard, 2020; Chun, Kwan, Strycker, & Chesla, 2016). Alakaam and colleagues proposed several barriers that affect international students' nutritional status and general wellbeing such as accessibility, economic and time constraints as well as dietary restrictions that limit a person's options in terms of obtaining food on University campuses (Alakaam et al., 2015). However, the major drawback of published articles related to dietary changes is the qualitative nature and self-reported data that offer no substantiated quantitative measures of actual change in food consumption and body weight (Alakaam & Willyard, 2020; Leu & Banwell, 2015; Martinez, Harmon, Nigg, Bantum, & Strayhorn, 2016). While dietary habits and body weight changes are often studied together (Schaben & Furness, 2018), physical activity is rarely reported in detail alongside with studies of dietary acculturation. Since weight change may not occur solely due to dietary modification but also due to changes in physical activity (Clark, 2015), this study focuses on examining the close relationship between dietary modification and physical activity change and how this relationship translates into weight change (if any). The scarcity of evidence that links dietary habits, physical activity and BMI changes among international students in the U.S. offers an important opportunity to identify dietary patterns and quantify (if available) changes in food consumption, physical activity and body weight. This study also examines changes in screen-time and duration of sleep because of their association with changes in body weight and food consumption (Christensen et al., 2016; Ding, Lim, Xu, & Kong, 2018; Myszkowska-Ryciak et al., 2020). This study provides a comprehensive overview and measurement of international students' BMI change three to six months after relocation to the U.S., as well as an evaluation of changes in dietary habits, physical activity, screen time and sleep duration.

II. *Literature Review*:

A. Determinants of Dietary Habits

Food choice is a complex process due to the many factors that are often interconnected and can be extremely difficult to measure (Shim, Oh, & Kim, 2014; Subar et al., 2015). Estimators can be used to indicate a specific factor playing a role in a person's food choice without directly asking about it. This method is used in qualitative research, where you thematically analyze participants' choices (e.g., if a person reported consuming low price food items, affordability would be considered as a factor for determining that person's type of diet; regardless of his/her ability to afford higher priced items (Subar et al., 2015). Shepherd R. proposed six determinants that influence an individual's dietary choice which include personal determinants such as psychological issues (e.g., stress and mood changes), country of birth, education level and status of health, economic determinants such as food cost in country or area of residence and income level, physical or place determinants such as accessibility to food items (e.g., food deserts), social determinants or social context that influence dietary choices, time constraints that often hinders individuals from adopting healthy choices. And finally, attitudes, beliefs and knowledge about food (Shepherd, 2005).

B. International Students' Dietary Behavior:

Another layer of complexity is faced when trying to identify in common factors influencing eating habits among international students because food choices are highly individualized and students have diverse perspectives when reflecting on their dietary behaviors in their home countries (e.g., types of food items considered healthy or

unhealthy, methods of cooking, etc.) (Leu & Banwell, 2015). While dietary changes are often reported by international students in the U.S., most of the evidence presented is self-reported and with no supporting objective measure for the proposed dietary change (Edwards, Hartwell, & Brown, 2010; Liu et al., 2020). Since international students are considered a subcategory of migrants due to the change in their geographical location (Delavari, Sønderlund, Swinburn, Mellor, & Renzaho, 2013; Satia, 2010), studies that investigate dietary acculturation for migrant populations can be compared with international students' changes in diet for those in the same age groups (Chun et al., 2016; Maxwell, Crespi, Alano, Sudan, & Bastani, 2012; White & Scarinci, 2015). Evaluating dietary changes and their associations to health indicators such as body weight, blood pressure, blood glucose level and general health management for migrant populations, were presented in several diet related manuscripts (Almohanna et al., 2015; Antonopoulou et al., 2020). Almohanna and colleagues found significant increase in international students' weights (mean 2.79 lbs., p-value 0.008) and there was no significant changes in mean systolic blood pressure and mean fasting blood glucose (Almohanna et al., 2015). Results showed that migrants have a health advantage over native populations during the first few years, while weight gain is perceived within 10-15 years of relocation and obesity risk was equal between migrant and native populations (Brussaard, van Erp-Baart, Brants, Hulshof, & Löwik, 2001; Murphy, Robertson, & Oyebode, 2017). Many of the published articles that discuss barriers to healthy dietary habits are qualitative in nature, which is appropriate for exploring barriers to healthy eating, however, the results are highly subjective and not generalizable to all international students studying in the U.S. (Leu & Banwell, 2015; Martinez et al., 2016).

C. International students and diet change:

Diet change is often reported by international students (Alakaam & Willyard, 2020). In a study that evaluated current knowledge, attitude and practices (KAP) towards diet and health among international students in Dublin in Ireland, 45.3% of participants had a broad concept of a healthy diet and younger and single participants were the most to report a change in their diet after relocation compared to older participants and those in a stable relationship (66.8%, p-value<0.05).

Several studies have investigated the factors influencing dietary habits as well as the impact of migration on dietary habits and weights of international students (Almohanna et al., 2015; Antonopoulou et al., 2020). One study reported an overall increase in mean caloric consumption among thirty-five international students from 1742 kcal to 1773 kcal after 6 weeks of relocation to the state of Virginia in the U.S. (Almohanna et al., 2015). Students also reported higher frequency of consumption for food items such as peanut butter, bagels, mashed potatoes, chicken nuggets, burgers and soda after 6 weeks of relocation (Almohanna et al., 2015). Some of these changes continued to increase with more time spent in the U.S. (e.g., burgers consumption increased from twice a month upon arrival to almost once a week after 12 weeks of relocation) (Almohanna et al., 2015)

One qualitative research study among 44 college age international students, used seven focus groups to explore the factors that influence dietary behaviors, reported diet-related influences such as he food environment, campus environment, religion, and individual preferences as the main factors (Alakaam et al., 2015; Alakaam & Willyard, 2020).

Alakaam et al. explored the barriers to adapting healthy eating habits. Ten focus groups of international students were created, of which eight were in two Midwestern U.S. universities and two in a Southern U.S. university (n = 44). Access to food, religious orientation, time constraints, campus environment, and healthcare access were reported as main factors shaping students' dietary behavior (Alakaam et al., 2015; Alakaam & Willyard, 2020). Dietary acculturation was found to be associated with weight gain; however these was no change in blood pressure and blood glucose levels (n=35) (Almohanna et al., 2015). Most of the published articles associate dietary changes to weight changes among international students without considering other factors that play a role in weight gain such as decreased physical activity, reduced sleeping hours and increased stress levels (Antonopoulou et al., 2020; Eliasson, Eliasson, & Lettieri, 2017).

D. Physical activity levels among international students:

Universities in the U.S. in general have been promoting physical activities by providing recreational centers and creating innovative challenges to engage its students in a healthier lifestyle such as promoting the use of fitness trackers (Schaben & Furness, 2018). A study among 18 undergraduate international students in the U.S. that explored the physical activity, diet and drinking behaviors from the perspective of international students found that most students became more physically active after arrived in the U.S. and were dissatisfied with their diet and drinking culture while in the U.S. (Yan & FitzPatrick, 2016).

A longitudinal observational study was done in 2009 by Wengreen and Moncur to evaluate changes in diet, weight and physical activity among students during the

transition from high school to college. One hundred and fifty-nine students were evaluated at the beginning of and end of fall semester 2005 at a public university in western United States; results showed that the average amount of weight gained during the 15-week study was modest (1.5 kg), 23% of participants gained ≥ 5% of their baseline body weight. Average weight gain among those who gained ≥ 5% of baseline body weight was 4.5 kg, they also reported less physical activity and longer sleeping hours compared to those with less weight gain (Wengreen & Moncur, 2009).

E. Sleep patterns and health status:

Sleep related problems such as insomnia has been recorded in up to 60% of college students (Schlarb, Friedrich, & Claßen, 2017). Sleeping problems can negatively affect students' health and academic performance (Faught et al., 2017). Moreover, insomnia can be associated with increasing risk of obesity (Ding et al., 2018). Sleep patterns have not been recorded for international students in the U.S. specifically. Eliasson A. and Lettieri C. investigated the differences in sleep habits, study time and academic performance between 120 US-born and foreign-born college students (41% were foreign-born). Comparisons between US-born and foreign-born students showed no differences in students grade point averages, weekday bedtimes, wake times, or total sleep duration on weekdays and weekends. However, on average, US-born students averaged 50 minutes less study time per day (p-value 0.01) and stayed up to socialize more frequently (63 vs. 43%, p-value 0.03) while foreign-born students woke an hour earlier and averaged 40 minutes less sleep per night on weekends; these differences were attributed to cultural differences by the authors (Eliasson et al., 2017).

F. Screen-time and Health Status:

Screen-time has been a concern after being associated with poor health outcomes such as obesity, depression and sleep disturbance (Andrade et al., 2015). A cross-sectional analysis was performed for 653 adults in the U.S. to determine factors associated with increased screen-time and evaluate the relationship between screen-time and poor sleep (Christensen et al., 2016). Screen-time was associated with shorter sleep duration and worse sleep-efficiency (Christensen et al., 2016). The exact effect of screen-time duration on weight gain is yet to be established, however, reducing screen-time was associated with healthier behaviors (Myszkowska-Ryciak et al., 2020). University students are prone to overusing electronics for schoolwork and entertainment (Penglee, Christiana, Battista, & Rosenberg, 2019) which may negatively impact their sleep, physical activity, stress level and overall health (Atkin, Sharp, Corder, & van Sluijs, 2014).

G. Weight Change Among International Students:

Diet is often the main focus of research done to examine change in body weight; however, there are other contributing factors that affect the net weight gained or lost such as decreased physical activity and metabolic rate (Faught et al., 2017). A comprehensive review was done in 2013 to assess dietary changes for international students and barriers to healthy living abroad concluded that rapid weight gain, disordered eating patterns and low activity have been reported among college students in the U.S. for both domestic and international students (Cahill & Stavrianeas, 2013). As mentioned in section 1. (International students and diet change), there have been studies that associated changes

in diet to reported changes in weight, however, none of these studies offer a comprehensive approach that linked diet, physical activity, sleep duration and screen time to weight change.

H. General Health Perception Among International Students:

While many previous studies aspired to associate the length of stay in a foreign country and changes in the health status on migrants (Brussaard et al., 2001; Chun et al., 2016; Ro, 2014), no studies compared international students' health perceptions with objective measurement and evaluation of their nutritional status and body weight measurements. Self-reported health perception among international students was negative along with self-reported weight gain in qualitative literature (Alakaam & Willyard, 2020; Shepherd, 2005). A comparison between perceived weight change, perceived general health status and objective anthropometric measurements can either support the qualitative evidence or refute it.

I. Research Question and Rationale:

The scarcity of evidence that provides an objective measurable change in dietary habits, physical activity, and body weight among international students in the U.S. necessitates the investigation of any change in dietary patterns, physical activity, and BMI after relocation of international students to validate self-reported weight gain and unhealthy food consumption. The research questions include the following:

1. Are there any changes in dietary patterns, physical activity and BMI among international students attending GSU or Emory University in GA, U.S. after 3 to 6 months of relocation?
2. What are the changes in dietary patterns, physical activity and BMI among international students attending GSU or Emory University in GA, U.S. after 3 to 6 months of relocation?
3. Are there any changes in screen-time and sleeping duration among international students attending GSU or Emory University in GA, U.S. after 3 to 6 months of relocation?
4. What are the changes in screen-time and sleeping duration among international students attending GSU or Emory University in GA, U.S. after 3 to 6 months of relocation?
5. What are international students' perceptions about their own weight and general health status after 3 to 6 months of relocation to GA, U.S.?

J. Conceptual Framework:

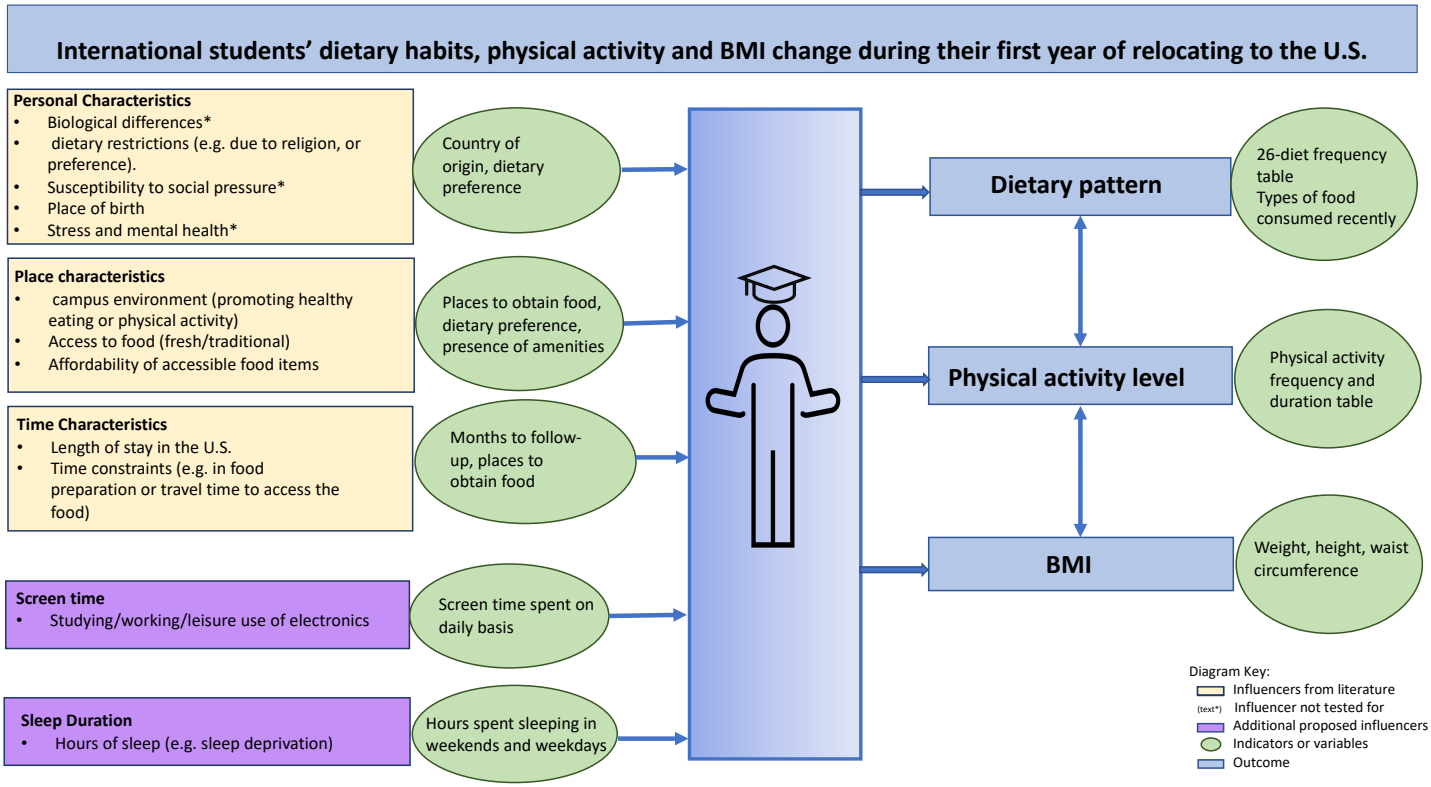
International students as a population are subjected to various facilitators and barriers to healthy eating and maintaining normal body weight. Modeling eating behavior is complex due to the countless factors that are interconnected and play a different role in food consumption. Individuals' food choices are based on their personal characteristics, the environment and time characteristics. Investigating dietary habits of international students adds another layer of complexity to the model due to the recent migration (including criteria: changing country of residence within the last 10 days) and all the accompanying physical and psychological changes.

The scope of this study is to identify changes in dietary habits, physical activity and BMI after 3-6 months of relocation to the U.S. Some influencers are adopted from the literature review and some are proposed influencers to change in dietary habits and BMI. The personal characteristics include biological differences, susceptibility to social pressure, and stress. These characteristics are not investigated in this study. Other personal characteristics include dietary restrictions and place of birth. Indicators for this category are country of origin and dietary preference reasons. Place characteristics such as the campus environment also plays an important role in shaping dietary habits and physical activity level. The presence or absence of amenities such as gyms, hiking trails, parks, etc. as well as types of food items available on campus and the affordability of these items are indicators for this domain. Time, especially for full time students is a major determinant of the type of food consumed. An indicator can be used for this influencer is time spent in cooking or obtaining certain food items. Length of stay (after relocation) can also be examined for any associations with changes to eating habits, physical activity and BMI among international students.

Other influences such as length of exposure to screen light and sleep duration are included due to the association of these factors with sleeping disturbance, sedentary lifestyle and consumption of high caloric food items.

Evaluating all changes (except for non-changing items such as country of origin and dietary preference due to medical/religious reasons) at different time points (baseline and follow-up) 3 months apart on 75 individuals; would produce an accurate description for dietary patterns, physical activity and BMI for international students studying at GSU or Emory University in GA, U.S.

Figure 1: Conceptual Framework for Observing Dietary Patterns, Physical Activity and BMI Changes among International Students After 3 to 6 months of Relocation.



III. Data and Methods

A. Study Population and Sampling Frame

The study population was all international students at Georgia State University (GSU), Rollins School of Public Health (RSPH) and Goizueta Business School (GBS) at Emory University, that relocated to the state of Georgia, U.S in July/August of 2018. The sampling frame included all international students participating in the international students' orientation sessions held on August 2018 for RSPH students at Emory, all international students attending on campus classes at GSU and GBS during the fall semester.

Emory and Georgia State Universities are two of the largest, most diverse universities in Atlanta, GA. Since the research team was based at Rollins School of Public Health at Emory University (20% of enrolled students were international for fall 2018) and the Department of Nutrition at Georgia State University, these locations were considered for sampling.

B. Instrument Design

Our team (Dr. Solveig Argeseanu, Dr. Nida Shaikh, Zainab Rabeeah and other research assistants) developed a study instrument for a prospective observational study that comprised two sections. The first section focused on self-reported or perceived dietary habits, physical activity level and general health status and the second section included objective measurement of body weight (kg), height and waist circumference (cm). The developed surveys were pre-tested among the research team members along with optimizing the research assistants' techniques in obtaining the anthropometric measurements over a period of 6 months. The baseline and follow-up surveys had similar structure in terms of containing a demographics section, a 26-item FFQ, which is a recommended method for prospective

studies of dietary assessments. Open ended questions were also included on types of foods previously and recently consumed, multiple-choice questions (MCQs) on cooking and purchasing groceries, physical activity table, open ended questions on screen-time duration per day, sleep duration on weekdays vs. weekends, perceived weight change and perceived general health status after relocation.

C. Ethics Committee Approval

Ethical approval was this study was obtained from Emory's Institutional Review Board (IRB) (study IRB number IRB00104642).

D. Data Collection

The study sample composed of a convivence sample (non-probability sample) of 120 international students; this included 30 from GSU, 42 from RSPH and 48 from GBS. Study candidates were recruited by flyers placed in hallways and elevators as well as approaching international students at new students' orientation events.

The cohort was followed using the email addresses they provided during recruitment. Of the 120 participants, 75 participants responded and completed both the baseline and follow-up rounds of data collection from October 2018 to April 2019, after 3 to 6 months since arrival to the U.S and comprised the final analytic sample.

E. Methods

The detailed FFQ allows accurate description of current dietary patters, describe changes in dietary patterns, when compared with the baseline FFQ, and evaluate frequencies of food

items consumption in relation to “perceived health status”. The same principle was used for describing physical activity among international students. A detailed 14-item physical activity table was used to describe current physical activity level of international students and it was compared with the baseline physical activity table to describe changes in physical activity after 3 to 6 months of relocation.

Descriptive tables with frequencies, percentages and confidence intervals were generated using SAS 9.4 (see results). Three free-listing questions about previously consumed food/drink items at home and consumed food/drink items after 3 to 6 months of relocation to the U.S. followed by two multiple-choice question, with select all that apply, to specify reasons for consuming (more or less) of the food items mentioned earlier compared to when they were in their home countries.

To represent the baseline wave, a symbol of “W0” was used as any measurements at this wave are considered to be values at time zero. To represent the first follow-up wave (after 3 to 6 months), a symbol of “W1” was used as any measurements taken at this time point are considered values at the first time point (3-6 months) of follow-up. This representation makes interpretation easier of the results, as there are multiple follow-up time points.

F. Variables:

The variables used in this study include region of origin, living status (alone vs. with family or friends), dietary restrictions, screen time and sleep duration time. The country of origin was determined by asking “In which country were you born?” in the baseline questionnaire with the following answer choices: China, Canada, Indonesia, India, Japan, Korea, Malaysia, Mexico, Pakistan, Thailand, Other, specify.

Residence status was determined by the question “Do you live alone, with roommates, or with family?” with the following answer options: alone, partner, roommate, spouse and/or children, other family (aunt/uncle/cousin/etc.).

As for dietary restrictions, two separate questions were asked to determine if the participant had any dietary restriction upon arrival to the U.S. The first question was “Do you have any dietary restrictions or avoid any foods or drinks?” with multiple response choices that included pork, beef, chicken, seafood, dairy products, nuts, alcohol, gluten, eggs, none, other, specify. The second question was focused on examining the reasons for the mentioned dietary restriction(s) with multiple choices that included personal belief, medical condition, advised by a doctor or nutritionist, other, specify. While the reasons for dietary restrictions provide a detailed review of international students’ dietary behaviors in their home country, only the first question was used in the analysis as dietary restrictions for any reason are an additional barrier for international students in accessing preferred food items. Screen-time was determined by asking “On a normal day since you have been in the US, about how much total time do you spend watching television or looking at a computer, phone, or iPad?” answers were given in hours per day (one decimal place). Sleep duration were determined by two questions to differentiate between hours of sleep on weekdays and weekends. “In the past week, how long do you sleep during weekdays (including naps)?” and “In the past week, how long did you sleep on weekends (including naps)?” Answers were given in hours per day (one decimal place).

The outcomes of interest in this study are changes in dietary patterns, physical activity levels, BMI, and general health perception. The indicators to measure these changes include a detailed 26-item FFQ (measuring frequency of consumption per week), 14-item physical

activity table (measuring frequency of performance per week and duration for the activity sessions per week). A general health perception was examined by asking "How would you describe your health? Would you say it is…" with a 5 Likert scale of very good, good, fair, poor and very poor. To explore changes in health perception, we included two open-ended questions on perception of weight change and perception of general health status after 3 to 6 months of relocation. Anthropometric measurements of body weight (kg), height (cm) and waist circumference (cm) were measured by a research assistant twice, then averaged for each participant. The weighing scale, stadiometer and measuring tape were used respectively to produce the readings. All instruments were calibrated prior to any measurement and the research team trained on using the equipment prior to data collection. Each measurement was repeated twice to reduce measurement errors. BMI was calculated for each participant after measuring body weight (kg) and height (cm), then by using the formula weight (kg) / [height (m)]2. BMI was then categorized into 4 categories, following the CDC guidelines for BMI classification and weight status. Below 18.5 was classified as underweight, 18.5-24.9 normal weight, 25.0-29.9 overweight, 30.0 and above obese.

All questions in both waves contained "Don't Know" and "Refuse to answer" which were coded as 88 and 99 respectively.

G. Analysis:

Dietary pattern was described by the 26-item FFQ. A detailed food-item consumption frequency table was generated for both the baseline and follow-up (see table 10. Appendix 2). We converted the responses to the FFQ into categorical variables 'food consumption in times per week' where we coded the following frequencies of consumption into numbers:

Everyday = 7, few times a week=3, once a week=1, few times a month=0.5, once a month=0.25, never=0.

Another table was generated when quantifying food items consumption, which composed of grouped similar items from the detailed food frequency table (e.g., green leafy vegetables, roots and other vegetables were grouped into one category labeled "vegetables") to produce a condensed food frequency table (see table 9. Appendix 1).

A diet diversity score (DDS from 0 to 26) was calculated by providing a score of 1 if the participant reported consuming an item and 0 for items reported never consumed. This score provides a number to indicate the diversity of international students' diet at baseline and follow-up.

Free-listing questions were analyzed and represented by using a word cloud generator www.wordclouds.com. Multiple-choice questions that contained "Select All that Apply" to determine reasons for consuming or not consuming previously listed items, were coded as "0" if not selected and "1" if selected. Percent of participants selecting "1" were calculated for each choice and represented by bar graphs.

The same coding method for the FFQ was done to convert frequencies of physical activity into numbers corresponding to the following:

Everyday = 7, few times a week=3, once a week=1, few times a month=0.5, once a month=0.25, never=0.

Mean time spent in each sport was reported for baseline and follow-up by calculating the mean duration of activity for every reported activity.

Missing observations were reported in frequency tables, indicated by (M), where up to 4 missing observations in the food frequency table and 2 missing observations in the physical

activity table. Listwise deletion was used to exclude the missing values from the analysis. Student's t-test was done for continuous variables including body weight, waist circumference, height, sleeping duration, physical activity duration and daily screen-time duration. Chi-square test was done for categorical variables including frequencies of food consumption and physical activity. Fisher's exact and Monte Carlo estimates were used when the cell count was <5. Paired t-test was done to compare screen-time and sleep duration differences between males and females. To describe health characteristics patterns among international students from different regions of origin, participants were aggregated according to their country of origin. Students' countries of origin were grouped into five regions (Americas, South Asia, East Asia, Europe, Middle East and Africa) depending on the location of the country and number of participating students from that region. Americas included Colombia, Venezuela, Mexico and Brazil. East Asia included China, Japan, Singapore, Korea and Mongolia. South Asia included India, Nepal and Bangladesh. Europe included Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Italy, Norway, Poland, Spain, Sweden. Middle East and Africa included Iraq, Israel, and Nigeria.

A paired t-test was done to compare each of BMI, height, body weight and waist circumference for participants in the same region between baseline and follow-up and ANOVA was used to compare anthropometric measurements of students among different regions.

IV. Results and Tables

Demographics and Health Characteristics:

Demographic information for participants (N=75) as well as their residence status, sources of grocery shopping, frequency of cooking and the health characteristics (BMI, weight, height and waist-circumference) are shown in Table 1. On average, participants were 25.3 ± 3.9 years old and 65.3% were females. Only five students changed their place of residence during the first 6 months of relocation. Almost 90% of participants lived with a roommate or a partner. Considering that Emory University and GSU are located in Atlanta, which is an Urban city, international students can find many options in grocery stores to shop from. Nearly all newly arrived students mainly shopped (94.7%) at regular chain supermarkets (e.g., Walmart), 16% shopped at an international supermarket, 28% shopped at a country specific supermarket and 10.7% at the universities' dining halls. After 3 to 6 months of settling in the U.S. Students grocery shopping from international supermarkets increased from sixteen to thirty-two percent and from twenty-eight to thirty-six percent for country specific supermarkets. Shopping from chain supermarkets remained relatively stable (93.3%) and using Universities' dining facilities increased from 10.7% to 24%. The majority of meals that students reported consuming were home cooked or prepared (96%) with 51.7% reported daily cooking while 38.7% reported cooking few times a week. Seventeen percent of participants reported having dietary restrictions that included beef, chicken, dairy, seafood, gluten, eggs, alcohol and soda. Overall health characteristics such as BMI, weight, height and waist circumference remained relatively similar after 3 to 6 months of relocation with marginal increase in BMI. Mean BMI changed from (22.3 ± 3.0) to (22.4 ± 3.0) and p-value > 0.05. A slight increase in overall body weight (62.6 kg ±

12.7 to 62.8 kg ± 12.7 and p-value > 0.05) and a decrease in overall waist circumference (78.2 cm ± 13.0 to 77.6 cm ± 13.0 and p-value > 0.05).

Table 1. International Students' Demographics and Health Characteristics (n=75)

Characteristic	*W0-baseline*[1]	*W1-follow up*[1]
Age [(M)]	25.2 years	25.4 years
Sex:		
Female	49 (65.3%)	49 (65.3%)
Male	26 (34.7%)	26 (34.7%)
Change in residence location (in the past 3 months)	75 (100%)	5 (6.7%)
Living off-campus	72 (96.0%)	72 (96.0%)
Living on-campus	3 (4.0%)	3 (4.0%)
Residence Status:		
Living alone	3 (4.0%)	2 (2.7%)
Roommate/partner	67 (89.3%)	64 (85.3%)
Spouse and/or children	3 (4.0%)	5 (6.7%)
Other (e.g., uncle/aunt/cousin)	2 (2.7%)	4 (5.3%)
Sources of Grocery Shopping:		
Supermarket	71 (94.7%)	70 (93.3%)
International supermarket	12 (16.0%)	24 (32.0%)
Country specific supermarket	21 (28.0%)	27 (36.0%)
Convenience store	1 (1.3%)	1 (1.3%)
Emory/GSU dining	8 (10.7%)	18 (24.0%)
Other **	2 (2.7%)	2 (2.7%)
Majority of Meals [(M)]***:***		
Cooking	67 (89.3%)	72 (96.0%)
Campus dining hall	2 (2.7%)	2 (2.7%)
Restaurants	5 (6.7%)	0 (0.0%)
Ready meals from the supermarket	1 (1.3%)	0 (0.0%)
Cooking Frequency:		
Daily	NA	38 (51.7%)
Few times a week		29 (38.7%)
Once a week		7 (9.3%)
Other		1 (1.3%)
Dietary Restrictions [(M)] ***	13 (17.3%)	NA
Health Characteristic [(M)] (2)		
BMI	22.3 (21.6-23.1)	22.4 (21.7-23.1)
Weight (kg)	62.6 (59.5-65.6)	62.8 (59.9-65.8)
Height (cm)	166.8 (164.3-169.2)	166.9 (164.4-169.4)
Waist circumference (cm)	78.2 (75.8-80.6)	77.6 (74.6-80.7)

International students at GSU and Emory University demographic information and health characteristics upon arrival to the U.S. and after 3 to 6 months of relocation.

(1) Reported frequency (percentage)

*** other include using apps like insta-cart and Emory village.*

****dietary restrictions include beef (17.3%) chicken (9.3%), seafood (12%) dairy (4%), alcohol (13.3%), gluten (1.3%), eggs (2.7%), soda (1.3%)*

(M)Missing frequencies: Age (W0: 1, W1:4), Majority of Meals (W1:1), Dietary Restrictions (W0:1), Health Characteristics (W0: 1, W1:4).

(2)Reported ed mean value (95% CI)

As for health characteristics patterns among international students from different regions of origin (see Table 2.), three participants completed their follow-up data collection online and did not have anthropometric measurements for W1, therefore, the sample size was reduced to 72 participants. Female participants made 66.7% of the sample. The majority of participants were from East Asia (32 students) which included China, Japan, Singapore, Korea and Mongolia. Participants from "Americas" region (n=7) had a slight increase in their BMI and weight (difference 0.2 and 0.5 kg respectively), but this increase was not statistically significant. Waist circumference increased from 76.7 cm to 78.4 cm ($p < 0.05$).

Students from East Asia (n=32) had similar anthropometric measurements from baseline to follow-up with a slight increase in waist circumference (0.5 cm difference). On the other hand, students from Europe (n=11) waist circumference increased from 76.9 cm to 80.1 cm at follow-up. Students from the Middle East and Africa (n=4) had slightly lower BMI and weight values (22.9 to 22.4, and 67.4 kg to 66.0 kg respectively). Their waist circumference decreased by 1.7 cm.

Participants from South Asia (n=18) had lower BMI at follow-up despite having the highest BMI of all the groups (mean 25.6) at baseline, and the change was statistically significant (paired t-test: t value 2.7, p-value =0.02). There was a slight decrease in weight and waist circumference difference by 5.8 cm less at follow-up.

Table 2: Health Characteristics of International Students' Upon Arrival to the U.S. (baseline W0) and after 3 to 6 months (follow-up W1) of Relocating Based on Region of Origin (n=72).

Characteristic	*Overall*		*Americas* [1]		*East Asia* [2][M]		*South Asia* [3][M]		*Europe* [4]		*Middle East and Africa* [5][M]	
Sample size	*72*		*7*		*32*		*18*		*11*		*4*	
	W0	***W1***	***W0***	***W1***	***W0***	***W1***	***W0***	***W1***	***W0***	***W1***	***W0***	***W1***
Sex [6] *Female* *Male*	*48 (66.7%)* *24 (33.3%)*		*5 (71.4%)* *2 (28.6%)*		*24 (77.4%)* *8 (25.8%)*		*10 (55.6%)* *8 (44.4%)*		*6 (54.5%)* *5 (45.5%)*		*1 (25%)* *3 (75%)*	
BMI[7]	*22.4* *(21.6-23.1)*	*22.4* *(21.7-23.2)*	*22.9* *(21.3-24.5)*	*23.1* *(21.3-24.8)*	*20.7* *(19.8-21.6)*	*20.8* *(19.9-21.6)*	*25.6* *(24.2-27.0) **	*25.3* *(23.9-26.7) **	*20.9* *(19.6-22.4)*	*21.7* *(19.9-23.5)*	*22.9* *(19.7-26.2)*	*22.4* *(18.9-25.9)*
Weight[7] *(kg)*	*62.6* *(59.5-65.7)*	*62.8* *(59.9-65.9)*	*61.6* *(52.4-70.7)*	*62.1* *(53.0-71.1)*	*55.8* *(52.1-59.6)*	*55.9* *(52.3-59.6)*	*70.9* *(64.9-76.9)*	*70.2* *(64.1-76.3)*	*65.5* *(58.3-72.7)*	*67.3* *(60.3-74.3)*	*67.4* *(49.3-85.5)*	*66.0* *(51.0-81.0)*
Height[7] *(cm)*	*166.8* *(164.3-169.3)*	*166.9* *(164.2-169.3)*	*163.5* *(153.8-173.1)*	*163.7* *(153.9-173.4)*	*163.8* *(160.7-166.9)*	*163.5* *(160.7-166.6)*	*166.1* *(161.3-170.9)*	*166.1* *(160.9-171.1)*	*176.4* *(168.2-184.6)*	*176.1* *(167.9-184.2)*	*169.7* *(157.6-181.9)*	*171.3* *(159.8-182.9)*
Waist circumference[7] *(cm)*	*78.2* *(75.8-80.6)*	*77.6* *(74.6-80.7)*	*76.7* *(70.0-83.3) **	*78.4* *(71.4-85.3) **	*71.9* *(69.3-74.6)*	*72.4* *(70.1-74.7)*	*88.7* *(84.7-92.6)*	*82.9* *(72.1-93.7)*	*76.9* *(71.7-82.8)*	*80.1* *(75.3-84.9)*	*82.3* *(71.1-93.5)*	*80.6* *(71.1-91.1)*

International students at GSU and Emory University divided according to their region of origin and sex, then represented their anthropometric measurements accordingly.
**P-value<0.05, paired t-test was done for W0 and W1 of each region and ANOVA was done to compare means among the different regions (e.g., BMI follow-up across regions)*
[1] Americas include Colombia, Venezuela, Mexico and Brazil.
[2] East Asia include: China, Japan, Singapore, Korea and Mongolia.
[3] South Asia include India, Nepal and Bangladesh.
[4] Europe include Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Italy, Norway, Poland, Spain, Sweden.
[5] Middle East and Africa include Iraq, Israel, and Nigeria
[6] values are n (%)
[7] values are mean (95% CI)
[M] missing frequency: a total of 3 participants did not have follow-up anthropometric measures. China(n=1), Nigeria (n=1) and Nepal (n=1)

There was no statistically significant change in the body weight, BMI and height between male and female participants from baseline to follow-up (see Table 3.). Male students' (n=26) waist circumference decreased from 86.6 cm to 82.8 cm, while female students' waist measurement increased from 73.7 cm to 75.0 cm at follow-up.

Table 3. Health Characteristics of International Students' Upon Arrival to the U.S. (W0) and after 3 to 6 months of Relocating (W1) for Males and Females.

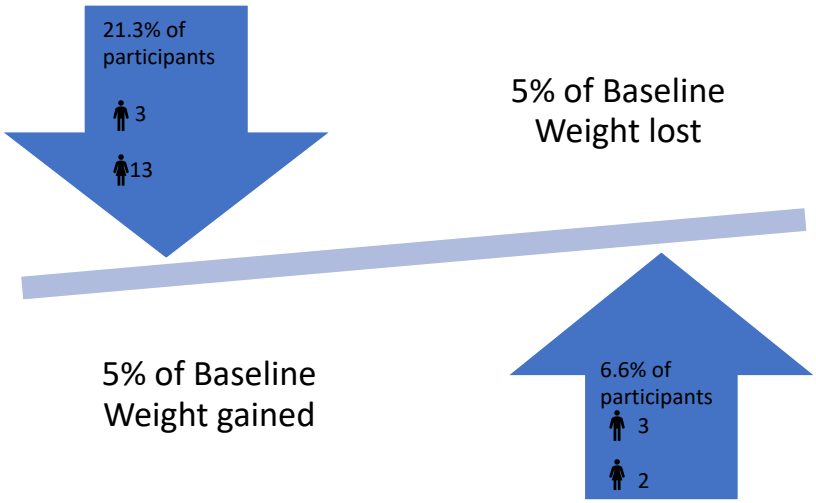
	Overall		***Male***		***Female***	
	W0[1]	***W1[1]***	***W0[1]***	***W1[1]***	***W0[1]***	***W1[1]***
Sample Size (N)	*75*	*72*	*26*	*24*	*49*	*48*
Characteristic:						
BMI	*22.4* *(21.6-23.1)*	*22.4* *(21.7-23.2)*	*23.92* *(22.6-25.2)*	*23.98* *(22.7-25.2)*	*21.5* *(20.6-22.3)*	*21.6* *(20.8-22.4)*
Weight (kg)	*62.6* *(59.5-65.7)*	*62.8* *(59.9-65.9)*	*75.1* *(70.5-79.7)*	*75.2* *(70.5-79.9)*	*55.8* *(53.5-58.1)*	*56.4* *(54.2-58.6)*
Height (cm)	*166.8* *(164.3-169.3)*	*166.9* *(164.2-169.3)*	*177.1* *(173.4-180.8)*	*177.3* *(173.3-181.2)*	*161.1* *(159.3-163.0)*	*161.6* *(159.6-163.0)*
Waist circumference (cm)	*78.2* *(75.8-80.6)*	*77.6* *(74.6-80.7)*	*86.6* *(82.9-90.2)*	*82.8* *(74.9-90.7)*	*73.7* *(71.4-76.0)*	*75.0* *(72.8-77.1)*

International students attending GSU and Emory University, grouped by sex and recorded overall health characteristics upon arrival to the U.S. and after 3 to 6 months.

(1)values: mean (95% CI)

Overall, 33% gained weight 3 to 6 months after relocation, 43% lost weight and 24% maintained their baseline weight. Upon examining the results of weight changes between the two sexes, there seems to be a trend among female participants to have more weight gain in comparison to male participants. As shown in Figure 2. Which describes weight change among international students after 3 to 6 months of relocation. Twenty-one percent of students (3 males and 13 females) gained 5% or more of their recorded baseline weight upon follow-up, while 6.6% of participants (3 males and 2 females), lost 5% or more of their recorded baseline weight upon follow-up. Only two participants (1 male and 1 female) gained 10% or more of their baseline weight.

Figure 2: International Students' Weight Change After 3 -6 Months of Relocating to the U.S.



Dietary Patterns:

Changes in frequency of consumption for food/drink items from the FFQ are presented in Table 4. Mean consumption is reported for the baseline and follow-up waves for each food item. Overall, consumption was decreased from baseline to follow-up for the following items: rice (4.8 to 3.7 times per week), beans (2.0 to 1.2 times per week), meat (3.6 to 3.2 times per week), honey (3.1 to 2.4 times per week), eggs (3.6 to 3.3 times per week), butter (4.2 to 3.3 times per week), seafood (1.1 to 0.6 times per week), fruits (4.4 to 3.2 times per week) and green leafy vegetables (4.2 to 3.2 times per week). Meanwhile, consumption of processed food like pizza, burger and snacks increased after relocation (0.6 to 1.1 and 1.2 to 1.7 times per week respectively). The consumption of cereal, bread, fermented foods (e.g., kimchi) and snacks remained constant. The consumption of grains (rice, couscous, etc.) and dairy products significantly decreased (from 4.8 to 3.7 times per week, p-value of 0.01) and (4.8 to 4.5 times per week, p =0.006), respectively. Beverages like juices (fresh or packed) and tea/coffee consumption was reduced at follow-up (1.7 to 1.4, 4.1 to 3.7 times per week respectively), while soft drinks and alcohol consumption was increased (1.1 to 1.5, 0.8 to 1.0 times per week respectively). Consumption of nuts and soup was less at follow-up while snacks and processed food increased at the same time point. The average DDS at baseline was 23.8 (minimum DDS= 16 and maximum DDS=26) and at follow-up was 22.5, minimum=13 and maximum=26.

A grouped food item consumption is presented in table 9. Appendix 1.

And the percentage change in food consumption is presented in table 10. Appendix 2.

Table 4. Detailed Food Consumption (times per week) of International Students Upon Arrival to The U.S. (W0) and After 3 to 6 Months of Relocation (W1).

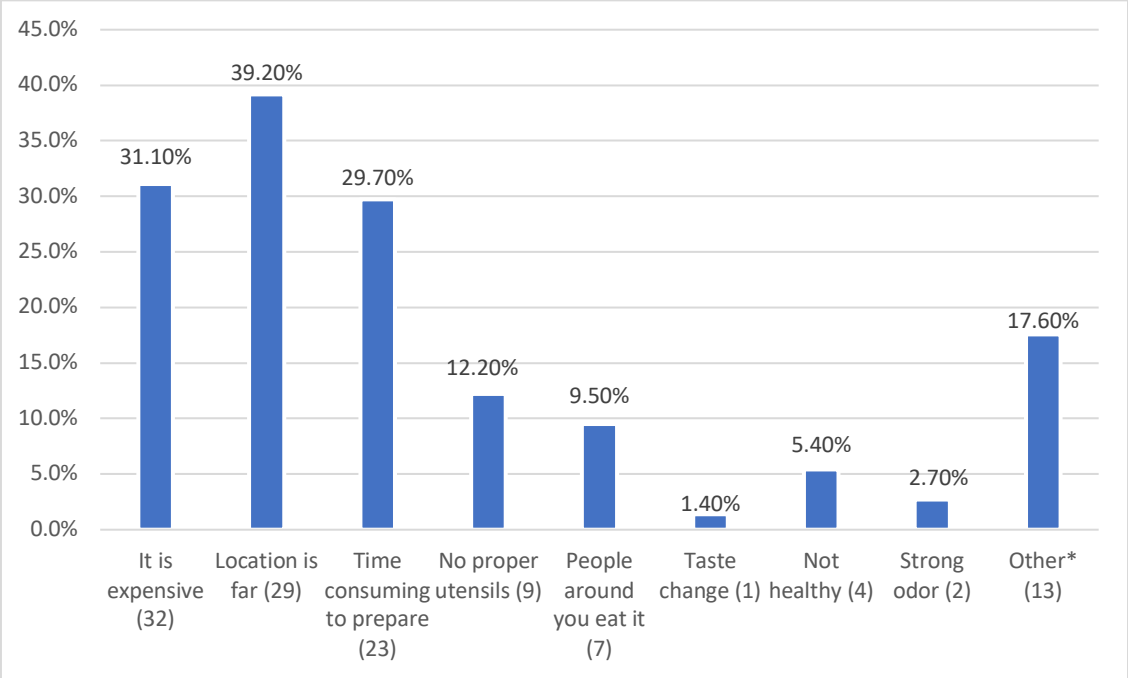
Food Item	*W0*[1]	*W1*[1]
Cereals [(M)]	2.0 (1.5-2.5)	2.1 (1.6-2.6)
Rice [(M)]	4.8 (4.2-5.4) *	3.7 (3.1-4.34) *
Bread	2.9 (2.3-3.4)	2.9 (2.3-3.4)
Beans [(M)]	2.0 (1.5-2.5)	1.2 (0.9-1.5)
Dairy	4.8 (4.2-5.35) *	4.5 (3.94-5.15) *
Eggs	3.6 (3.0-4.1)	3.3 (2.7-3.9)
Meat [(M)]	3.6 (2.9-4.3)	3.2(2.6-3.8)
Chicken	2.9 (2.4-3.4)	2.7 (2.2-3.2)
Seafood [(M)]	1.1 (0.9-1.4)	0.6 (0.5-0.8)
Fruits [(M)]	4.4 (3.9-4.9)	3.2 (2.7-3.8)
Juice	1.7 (1.2-2.1)	1.4 (0.94-1.91)
Green Leafy Vegetables	4.2(3.6-4.7)	3.2(2.6-3.8)
Roots	3.1 (2.7-3.5)	1.9 (1.5-2.3)
Other Vegetables	2.7 (2.3-3.1)	1.8 (1.4-2.2)
Nuts	1.9 (1.3-2.4)	1.4 (1.0-1.9)
Sweet Snacks [(M)]	1.4 (1.02-1.7)	1.6 (1.2-2.1)
Desserts	1.1 (0.9-1.4)	1.3 (0.9-1.7)
Butter	4.2 (3.6-4.9)	3.3 (2.7-3.9)
Honey	3.1 (2.4-3.7)	2.36 (1.76-2.96)
Pizza and Burger	0.6 (0.5-0.7)	1.1 (0.8-1.3)
Soup	2.1 (1.6-2.6)	0.9 (0.7-1.2)
Savory Snacks [(M)]	1.2 (0.9-1.5)	1.7 (1.3-2.1)
Tea or Coffee [(M)]	4.1 (3.3-4.8)	3.7 (3.1-4.4)
Soft Drinks	1.1 (0.8-1.4)	1.5 (1.1-1.9)
Alcohol [(M)]	0.8 (0.5-1.2)	1.0 (0.7-1.3)
Fermented food	0.4 (0.2-0.7)	0.4 (0.2-0.7)
Diet Diversity score (range 0-26)[(2)]	23.8 (23.3-24.3)	22.5 (21.9-23.2)

International students' (at GSU and Emory University) detailed dietary patterns upon arrival to the U.S. and after 3 to 6 months of relocation.
**P-value<0.05 Chi square, Fisher's exact and Monte Carlo estimate for comparing frequencies of W0 and W1.*
[(1)] values: mean (95% CI)
[(M)] Missing Frequency: Cereal (W1: 1), Rice (W0:1), Beans (W0:1), Meat (W0:2), Seafood (W0:1), Fruits (W1:1), Sweet Snacks (W0:2), Savory Snacks (W1:4), Tea or Coffee (W0:1), Alcohol (W0:3)
[(2)] A diet diversity score was calculated by providing a score of 1 if the person consumed the food item and 0 if he or she did not consume each food group and summing the scores for the 26 food groups in the FFQ. The diet diversity score ranged from 0 to 26.

Figure 3. shows a word cloud generated from the open-ended responses by international students when asked to write three food items or drinks that they used to frequently consume but rarely have after their relocation to the U.S. International students reported consuming more of fresh vegetables (e.g., green leafy vegetables, salads, etc.) and fruits in their home countries compared to after relocation. Traditional or ethnic dishes was often mentioned according to the international student's region of origin (e.g., Pani-Puri, dosa, idli, dumplings, etc.). Other items mentioned included fish, milk, chicken, milk-tea, cheese and other items. Reasons accompanying the reduced consumption of the mentioned items are represented in Figure 4. As participants could selected multiple responses, we found 39% of students stated that they were located far from restaurants or supermarkets offering these items, 31.1% reported that these items were expensive in the U.S., 29.7% stated that it was time consuming to prepare the dishes mentioned earlier and almost 18% reported dissatisfaction with food items sold in the U.S. in terms of their freshness, quality, availability and lack of knowledge to prepare traditional dishes. Other infrequently reported reasons included the lack of proper utensils to prepare complicated dishes, people on campus or around them do not eat it, the items mentioned are unhealthy, strong odor and their taste has changed.

Figure 3: Food Items and Drinks Previously Consumed by International Students Frequently But are Rarely Consumed After 3 to 6 Months of Relocation.

Figure 4: Reasons Reported by Participants for Rarely Consuming Food Items and/or Drinks Previously Consumed at Home Country.



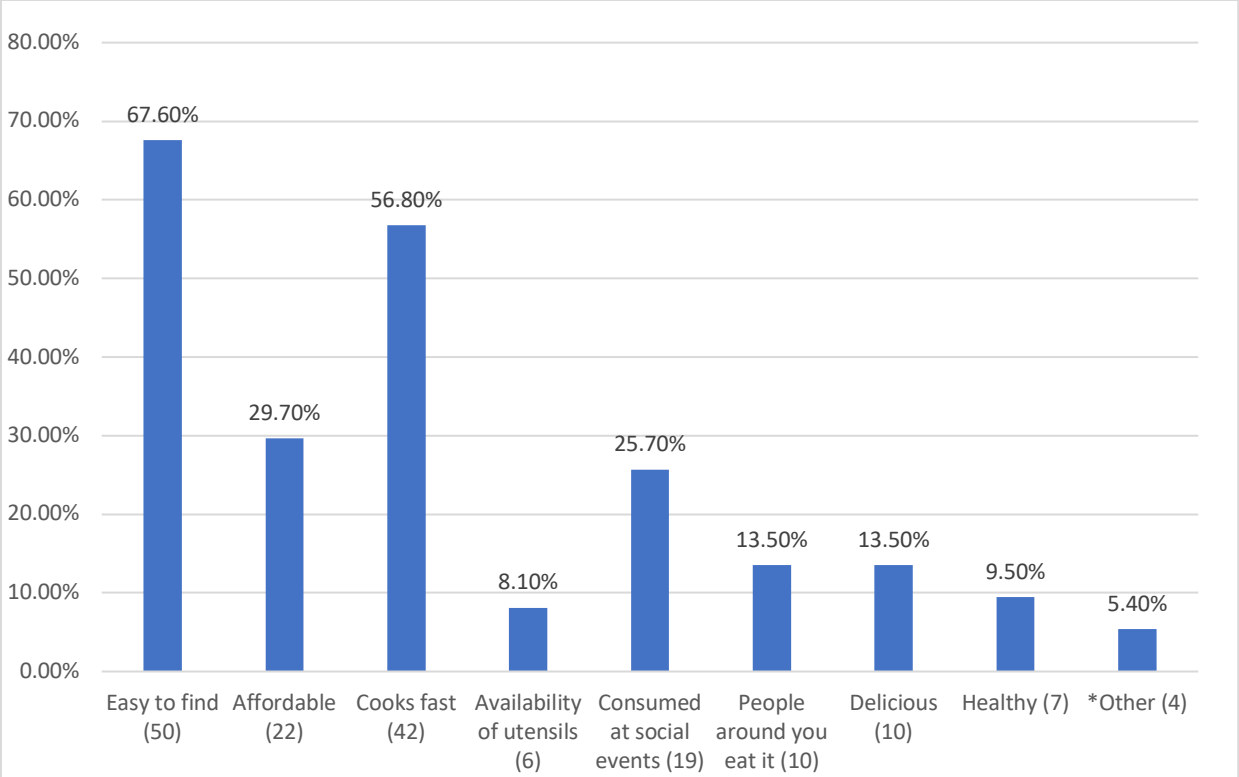
*Other category includes not as fresh, less quality, difficult preparation, ingredients are unavailable in the U.S.

Figure 5. Shows a word cloud generated from the open-ended responses by international students when asked to write three food items or drinks that they are consuming more frequently after 3 to 6 months of relocation. The most frequently mentioned items were pizza (15 mentions), bread (12 mentions) and soft drinks such as coke (8 mentions). Students also reported consuming more of cheese, meat, pasta (3, 4 and 3 mentions respectively). Students reported consuming more fast-food items like burgers (5 mentions), mac and cheese (5 mentions), noodles (3 mentions), chips (3 mentions) and cookies (6 mentions). Participants reported consuming fruits, orange juice and various vegetables, however, some were starchy or heavy such as corn, avocado, potatoes and sweet potatoes.

Sixty seven percent of participants, as shown in Figure 6., reported that the items they mentioned were easy to find around them, hence, they consumed them more often. Almost 57% of participants reasoned that the items they consumed more often were faster to cook and prepare. While 30% of students reported affordability as a reason and 25.7% reported that the items they mentioned were commonly consumed or served at social events (e.g., pizza was distributed during noon conferences at RSPH). The remaining students stated their reasons for consumption to be that people around them frequently ate these food items, it has good taste, they had appropriate utensils to make these items and they were perceived to be healthy.

Figure 5: Food Items and Drinks Currently Consumed More Frequently in the U.S. Compared to Home Country

Figure 6: Reasons Reported by Participants for Increased Consumption of Food Items and/or Drinks that are Rarely Consumed at Home Country.



*Other include can't afford fresh/organic items, offered items at events such as pizza, did not cook back home and don't know.

Physical Activity Patterns:

To address the second part of the research question, we examined the frequency (times per week) of preforming several sports and general activities in addition to the duration (in minutes) reported with each activity. The general trend upon comparing physical activity between baseline and follow-up shows (see Table 5.), various sports were performed regularly such as walking and running (N=70 and more), yoga, football, basketball (N= 10 or less), tennis, hiking, biking, dancing, weightlifting and household cleaning (N=65 to 30). The least sport practiced was volleyball (N=4).

All sports were reported at lower frequencies at follow-up except for walking and hiking. The number of participants performing these sports also decreased except for students reporting walking, hiking and household cleaning (+1 participant or more). Statistical frequency test showed a Monte Carlo estimate P-value of 0.007 for football, 0.0084 for household cleaning and 0.0032 for swimming.

The table also shows the changes in time spent while performing these activities (duration in minutes). The mean duration was calculated only for students reporting the physical activity to be in any category except for never (0), the number of participating students to generate the mean value is indicated by (N=x) for each activity.

For participating students, the duration of activities increased for all sports except for hiking, tennis, household cleaning, weight exercise and other activities such as kickboxing, horse-riding, skiing, squash and Pilates.

A paired t-test was done for the continuous variables of duration and the results showed a statistically significant increase in duration (p-value <0.05) of yoga, football, basketball, dancing and weight exercise.

Table 6. shows similar information as Table 5. However, the estimates of mean duration of each activity included all participants (including those who answered “never” for practicing the sport, and 0 minutes for the activity). This resulted in changing the estimates for mean duration of each activity. As the number of participants increased (answering “never” for frequency and “0 minutes” for duration), the estimate of mean duration decreased. For reviewing detailed physical activity in proportions, please review appendix 3. Table 11.

Table 5. Detailed Physical Activity (type/duration) Performed (times per week) by International Students Upon Arrival (W0) and After 3 to 6 Months of Relocation (W1).

Activity	W0-Activity [1] (Times per week)	W1- Activity [1] (Times per week)	W0-Activity Duration[1] (minutes) N=(x)	W1- Activity Duration[1] (minutes) N=(x)
Walking (M)	5.2 *(4.6-5.7)*	5.5 *(4.95-6.0)*	45.6 (39.5-53.4) N=70	44.7 *(36.0-53.3)* N=73
Running	1.6 (1.2-2.1)	0.95 (0.65-1.26)	25.4 (25.4-38.9) N=71	36.2 (29.7-42.7) N=48
Yoga	0.5 (0.2-0.8)	0.30 (0.12-0.78)	36.6 (26.8-46.3) ** N=22	40.29 (30.3-50.3) ** N=17
Football (M)	0.17 (0.05-0.3) *	0.19 (-0.03-0.41)	54.6 (43.2-66.1) ** N=14	105 (78.65-131.3) ** N=6
Basketball	0.07 (-0.01-0.16)	0.05 (-0.028-0.14)	47.1 (32.3-61.9) * * N=7	60 (21.02-98.98) ** N=4
Tennis	0.2 (0.01-0.4)	0.21 (0.05-0.37)	84.2 (51.6-116.8) N=13	65.4 (47.4-83.4) N=13
Hiking	0.16 (0.07-0.25) *	0.28 (0.07-0.48) *	149.6 (110.3-188.9) N=24	116.6 (94.7-138.5) N=30
Swimming	0.32 (0.16-0.5) *	0.29 (0.055-0.54)	50.0 (40.2-59.8) N=30	55.2 (37.9-72.4) N=13
Biking	1.1 (0.6-1.5)	0.44 (0.13-0.74)	38.3 (28.6-47.9) N=38	48.4 (30.3-66.5) N=16
Dancing (M)	0.4 (0.16-0.65)	0.32 (0.14-0.5)	48.3 (36.1-60.6) ** N=27	57.5 (36.0-78.99) ** N=22
Household cleaning	2.1 (1.5-2.7)	1.68 (1.2-2.2)	46.3 (38.5-54.2) N=64	45.2 (36.9-53.4) N=65
Volleyball	0.01 (-0.001-0.2)	0	52.5 (28.6-76.4) N=4	0
Weight exercise	1.03 (0.7-1.4)	0.83 (0.46-1.2)	45.4 (36.3-54.5) ** N=35	42.6 (34.5-50.7) ** N=34
Others ***	2.7 (0.9-4.4)	2.0 (-10.7-14.7)	82.5 (56.5-108.5) N=8	53.8 (-18.4-125.9) N=4

(1)values: mean (95% CI)

International students' (at GSU and Emory University) detailed physical activity performance upon arrival and after 3 to 6 months of relocation in GA, U.S.

**P-value <0.05 using Chi-square and Fisher's exact estimates of comparing frequency of activities between W0 and W1.*

***P-value<0.05 using t-test when comparing duration means between W0 and W1.*

****Other activities include kickboxing, ultimate, skiing, squash, horse riding, Pilates and other home workouts.*

(M) Missing Frequency: Walking (W0:1), Football (W0:1), Dancing (W0:1, W1:1)

Table 6. Detailed Physical Activity (type/duration) Performed (times per week) by International Students Upon Arrival (W0) and After 3 to 6 Months of Relocation (W1).

Activity	W0-Activity [1] (Times per week)	W1- Activity [1] (Times per week)	W0-Activity Duration[1] (minutes)	W1- Activity Duration[1] (minutes)
Walking (M)	5.2 *(4.6-5.7)*	5.5 *(4.95-6.0)*	45.6 (38.7-52.5)	43.5 *(34.9-52.0)*
Running	1.6 (1.2-2.1)	0.95 (0.65-1.26)	25.4 (19.3-31.4)	35.5 (28.9-42.0)
Yoga	0.5 (0.2-0.8)	0.30 (0.12-0.78)	11.6** (6.7-16.5)	40.3** (30.3-50.3)
Football (M)	0.17 (0.05-0.3) *	0.19 (-0.03-0.41)	10.5** (5.1-15.9)	190.0** (47.6-132.4)
Basketball	0.07 (-0.01-0.16)	0.05 (-0.028-0.14)	4.4** (1.1-7.7)	48.0** (5.5-90.5)
Tennis	0.2 (0.01-0.4)	0.21 (0.05-0.37)	15.6** (6.1-25.2)	60.7** (41.3-80.1)
Hiking	0.16 (0.07-0.25) *	0.28 (0.07-0.48) *	88.0 (6.0-170.0)	112.9 (90.4-135.4)
Swimming	0.32 (0.16-0.5) *	0.29 (0.055-0.54)	21.4** (14.4-28.4)	51.2** (33.2-69.2)
Biking	1.1 (0.6-1.5)	0.44 (0.13-0.74)	20.8** (13.9-27.5)	45.6** (27.6-63.5)
Dancing (M)	0.4 (0.16-0.65)	0.32 (0.14-0.5)	18.1** (11.0-25.2)	55.0** (33.9-76.1)
Household cleaning	2.1 (1.5-2.7)	1.68 (1.2-2.2)	42.3 (34.5-50.1)	43.2 (34.9-51.3)
Volleyball	0.01 (-0.001-0.2)	0	2.8 (-0.02-5.6)	0
Weight exercise	1.03 (0.7-1.4)	0.83 (0.46-1.2)	22.2** (15.4-28.9)	40.2** (31.9-48.5)
Others ***	2.7 (0.9-4.4)	2.0 (-10.7-14.7)	8.8** (2.5-15.1)	43.0** (14.2-100.2)

International students' (at GSU and Emory University) detailed physical activity performance upon arrival and after 3 to 6 months of relocation in GA, U.S.

(1) Mean (95% CI)

**P-value <0.05 using Chi-square and Fisher's exact estimates of comparing frequency of activities between W0 and W1.*

***P-value<0.05 using t-test when comparing duration means between W0 and W1.*

**** Other activities include kickboxing, ultimate, skiing, squash, horse riding, Pilates and other home workouts.*

(M) Missing Frequency: Walking (W0:1), Football (W0:1), Dancing (W0:1, W1:1).

Screen-time and Sleeping Patterns:

Screen-time increased from baseline to follow-up by almost 3 hours, while sleeping hours decreased by half an hour. Paired t-test was done and the means for screen time had a t-value of -5.3 and a p-value <0.0001 while sleeping duration had a t-value of 2.75 and p-value of 0.008 (see Table 7.).

There was no statistically significant difference when comparing screen-time or sleep duration mean estimates between males and females (p-value>0.05) or among international students from different regions of origin (p-value>0.05).

Table 7. Screen-time and Sleeping Hours for International Students Upon Arrival to the U.S. and After 3 to 6 Months of Relocation.

	W0[1]	W1[1]
Screen time [(M)] (hours/day)	4.2 (3.6-4.9)	7.0 (6.2-7.8) *
sleep duration, weekdays (hours/day)[(M)]	7.6 (7.2- 7.9)	7.05 (6.8-7.3)
Sleep duration, weekend (hours/day)	NA**	8.1 (7.8-8.4)

International students (at GSU and Emory University) estimates of screen-time duration in hours per day and sleeping duration in hours per day upon arrival and after 3 to 6 months of relocation in GA, U.S.

(1) values: mean (95% CI)

**p-value<0.05 using paired t-test in comparing screen-time spent at baseline and follow-up.*

***Follow-up survey contained 2 questions on sleep (weekdays vs. weekends) while the baseline survey contained one question about sleeping hours on a regular day (see appendix 2).*

(M) Missing frequency: Screen time (W0:6, W1:4), Weekdays sleeping (W0:3).

Health Perception Among International Students:

Fifty three percent of students perceived their health to be good. The majority of students perceived a change in their weight after relocation (69.3%). Of those, 64.7% perceived their weight to have increased while 27.5% perceived their weight to have decreased at follow-up. About 47% of students perceived a change in their health after relocation. Of those, 74.3% perceived their health to have deteriorated during their stay in the U.S. as they reported having frequent flu and cold episodes, increased stress and general tiredness (see Table 8.).

Table 8. Health Perception Among International Students after 3 to 6 Months of Relocation.

N=75	**W1[1]**
Reported Health Perception:	
5-Likert scale of perceived health • Very good • Good • Fair • Poor • Very poor	 7 (9.3%) 40 (53.3%) 23 (30.7%) 4 (5.3%) 1 (1.4%)
Perceived Change in Weight[2]: • Increased • Decreased	52 (69.3%) 33 (64.7%) 14 (27.5%)
Perceived Change in Health[2]: • Improved • Deteriorated	35 (46.7%) 6 (17.1%) 26 (74.3%)

Body weight and health change perception among international students (at GSU and Emory University) after 3 to 6 months of relocating to the U.S.

(1) n (%)

(2)Perceived change in weight and health were reported for other participants were don't know, increased or decreased and less or more muscles.

V. Discussion:

The aim of this study was to observe if there is a change in dietary patterns, physical activity and BMI among international students after their relocation to the U.S. In addition to objectively measure and report changes in dietary patterns, physical activity and BMI among international students after short term relocation to the U.S. Most of the studies done on nutrition and weight changes among international students were qualitative in nature and relied on self-reported or perceived changes in weight or dietary patterns (Alakaam & Willyard, 2020; Leu & Banwell, 2015). While other studies reported weight changes among migrants (Brussaard et al., 2001) and elementary school children (Faught et al., 2017). Results from these studies suggest a tendency to gain weight and consume unhealthy food items after staying in the U.S. (Alakaam & Willyard, 2020; Leu & Banwell, 2015). International students reported consuming unhealthy food items, which was consistent with the results from Alakaam, Lue and colleagues, however, our results show a modest weight change during 3 to 6 months of relocation with an average of 1 kg increase in weight. Forty-three percent of participants lost weight and 6.6% of students lost up 5% or more of their recorded baseline weight.

- Dietary Patterns

Follow-up self-reported food frequency consumption was similar to consumption frequency at baseline with slight decrease in grains, meat, fruits and vegetables consumption. On the other hand, an increase in consumption was reported for soft drinks, alcohol, snacks and double consumption of processed food such as pizza and burger (mean 0.58-1.1 times per week).

Food diversity score was calculated to indicate the diversity of a dietary pattern. There was a decrease in the DDS from 23.8 to 22.5 that resulted less frequent consumption of green leafy vegetables, beans and roots vegetables. International students reported consuming fewer fresh vegetables and fruits (reported 30 and 12 mentions respectively), students also reported consuming less traditional food items to their home country (e.g., Indian and Asian food). The main reasons for not consuming these items as reported by students were the distant location for international restaurants or stores (39.2%), cost (31.1%) and it is time consuming to prepare the previous dishes (29.7%), other reasons (17.6%) were also given such as fresh fruits or vegetables not as fresh, of a less quality or simply unavailable. As for food items that are consumed regularly now; students reported having more pizza, bread and soda such as Coca-Cola (15, 12 and 8 mentions respectively). Students also reported consuming more cheese, pasta, fast-food items like burgers, mac and cheese, chips and cookies because they are easier to find (67.6%), less time for preparation (56.8%), affordable (29.7%) and commonly presented at social events (25.7%).

Overall, there is a change in the reported dietary pattern among international students after 3 to 6 months of relocating to the U.S. and this change appears to shift towards fast-food and soda rich diet. This change is brought up by the lack of time to prepare food, distant location of international food stores and types of available food items on campus.

- Health Characteristics

While the overall weight, waist circumference and BMI did not significantly change during the first 3 to 6 months of relocation, students of different areas of origin displayed varying changes to these measures; international students from the Americas, Europe and East Asia had an

increase in their BMI, weight and waist circumference (2-3 cm on mean waist circumference). International students from South Asia, Middle East and Africa had decreased measurements with an average of 1 kg loss of mean weight and 1 to 2 cm loss on waist circumference. Anthropometric measurements did not differ when compared between males and females. However, female participants had more weight gain (+1 kg) and almost 2 cm increase in waist circumference compared to their baseline data. Males, comprising 35% of this sample had up to 4 cm decrease on waist circumference. Within participants who gained 5% of their recorded baseline weight, 13 were females and 3 were males, while only 2 female participants lost 5% of their baseline weight compared to 3 males. Extreme weight changes in 3 to 6 months (10% of baseline weight gained) were distributed equally between males and females (1:1).

- Physical Activity

Upon measuring self-reported frequencies of different sports, usual activities such as walking for errands, household cleaning were reported more frequently than in baseline and among more participants (3,1 participants respectively). Hiking was also reported more frequently among students (0.16 to 0.28) times per week, in addition to an increase in number of participants reporting hiking (6 more students compared to baseline).

Other sports such as running, yoga, football, basketball, swimming, volleyball, biking and dancing were reported with lower frequencies and less participants reported practicing them. However, duration of activity (in minutes) was increased for those who reported engaging in these sports. Tennis and weight exercise were reported similarly between baseline and follow-up.

- Screen-time and Sleeping Pattern

Screen-time significantly increased from 4.2 hours per day at baseline to 7.0 hours per day upon follow-up. This increase could be attributed to the fact that the students' baseline numbers were reported at the end of their summer vacation and the follow-up was done during the first semester of the school year. Most schoolwork is usually done electronically (e.g., online lectures, online submission of assignments and homework). Sleeping duration slightly decreased from 7.6 to 7.1 hours per day, with an average of 1 additional hour spent sleeping during weekends.

- Health Perception

More than half (53%) of students reported their current health as good, 30.7% perceived their health as fair. About 69% of participants perceived a change in their weight (64.7%) believed that their weight increased, 27.5% believed that their weight decreased. Overall perception of health was perceived to have changed for 46.7% of the students, 17.1% perceived an improved overall health while 74.3% perceived deterioration of their health. It is interesting that more participants (64.7%) perceived an increase in their weight while upon measuring students' weights, only 33% gained weight and a lower percentage gained more than 5% of baseline weight (21.3%).

Of the students perceiving a change in overall health, up to 74.3% of international students perceived deterioration in overall health. Some students expressed their concerns about increased stress levels that accompany short term migration, studying and social interactions, others mentioned alcohol consumption and school environment as additional factors that contributes to their perception of deteriorating health. This particular finding emphasizes the importance of studying and supporting mental health research among short term migrant populations such as international students.

- Strengths and limitations

While the detailed food frequency table helps capture dietary patterns and changes in the frequency of food consumption, it did not specify the portion sizes consumed for each category; this hinders our ability to compare the amount of food consumed and comparison with the recommended dietary guidelines. Moreover, dietary guidelines are usually tailored to the specific needs of a nation. Despite the challenge in producing a meaningful comparison between international students' dietary pattern upon arrival, after 3 to 6 months of relocation.

Participants reported consumption of food items as times per week, which was converted into groups arithmetically by starting from every day a week=7 then decreasing the number to 3 to correspond to few times a week, then 1 to represent once a week, 0.5 for few times a month 0.25 for once a month and 0 for never. The proposed scale may not necessarily reflect the actual number of times or proportions for consuming a food item per week; however, it makes the results easier to interpret and can produce an estimate for consuming specific food items.

The anthropometric measurements provide objective results that may not be reflected in self-reported data. In addition, this study provides an overview of lifestyle practices of international students at Emory University and Georgia State University that include dietary pattern, physical activity and other nutrition related factors.

VI. Conclusion

According to the findings, newly arrived international students in the U.S. did report changes in their dietary patterns after 3 to 6 months of relocation, however, the overall reported change was not associated with significant change in their BMI or body weight. Twenty-one percent of students gained ≥ 5% of their recorded baseline weight and 6.6% of students lost ≥ 5% of their recorded baseline weight. Weight changes differed according to areas of origin but did not differ between sexes. The percentage of students that perceived weight gain was 1.4 times the actual percentage of students who gained weight (65% perceived weight gain, 33% gained weight). On the other hand, 21% of students perceived weight loss while 43% of students lost weight during their stay in the U.S. Physical activity remained at similar rates to baseline levels. Screen-time was significantly increased from 4.2 to 7.0 hours per day, while sleep duration decreased by 0.55 hours per day. International students were concerned with their overall health status change after relocation as 73% of them perceived deterioration in their overall health which they related to increased stress and perceived reduction in immunity. Findings, while generalizable to the study sample only, emphasize the need to measure changes in body weight as the perception of weight change among international students may not be reflective of actual body weight change. Also, there is a need to address mental health issues among international students, more specifically stress; and measure its effects on overall health status as well as its association with certain types of foods consumed among international students.

VII. Reflections on My Experience:

As an international student myself, I arrived in the United States on August 1st of 2018. I attended the international students' orientation event that was held at Rollins School of Public Health on August 15th, 16th and 17th of 2018. I remember seeing Dr. Nida Shaikh and Dr. Solveig Cunningham asking international students if they are interested in participating in a study that explores dietary patterns, physical activity and body image perception among newly arrived international students. One of the goals of the project was to capture a diverse sample, record their recent food consumption pattern and physical activity back home and their perception of what foods are considered healthy and what body image they associate with. Another aim was to compare between what students perceive general body shapes in their home countries vs. in the United States.

I was intrigued by the study and went on to register as a participant. The process of registration, making sure that I was eligible and reading the consent form was very thorough. After completing the survey, it was reviewed to make sure I didn't miss any question, then Dr. Shaikh guided me to a private room where a research assistant took my anthropometric measurements. I was fascinated by how friendly and thorough everyone was in the research team! I immediately asked the research assistant on her experience in talking to many international students as I was very shy; the student explained how it's interesting to meet people from around the world and view body images in the U.S. and health from their perspective.

During my first semester at RSPH, I talked to Dr. Cunningham and Dr. Shaikh and expressed my interest in joining their research team for the same study in the follow-up wave. I was trained on designing surveys, taking accurate anthropometric measurements and data entry.

I started collecting the follow-up data after 3-6 months for the same cohort of students at RSPH, GBS and GSU. Many of the students at RSPH were my friends by that time, which made the follow-up scheduling and communication easier. I truly had a wonderful experience when I collected data at GBS and GSU because I met many new people from different countries and different environments. While students' responses from RSPH were somewhat similar, students from GBS and GSU offered a unique perspective for international students. I felt they were interacting with local communities a lot more than international students at RSPH.

I had a couple of concerns before starting data collection including some thoughts of what could go wrong. If I was a participant and an interviewer for others, would that affect the way they answer our questions? Would my interpretation be accurate of what others are saying? What if said or spelled something incorrectly as English is not my first language? I was reassured by the training that Dr. Shaikh recommended prior to this phase and the friendliness of international students. As for my concerns about introducing bias to the results, we made sure that the survey was self-administered rather than interviewer based. Since I was talking to mostly international students whose mother language may not be English as well, some of that self-consciousness was relieved and I never had an issue with communication.

Some of the challenges that I faced during data collection were overcoming my shyness and measuring waist circumference! Waist circumference needed to be measured by placing a measuring tape and adjusting it around the waist and the reading was done near the navel. Many students were reluctant to hold their shirts/sweaters up while I was measuring. As a research team, we trained on measuring waist circumference several times before actual data collection and we made sure there is a private room where we collected the data.

As I was reading the field notes, I remembered that we collected the follow-up data during the winter months which made some students reluctant to remove their heavy sweaters before taking their measurements. We did ask them to remove their jackets and boots/shoes, but some kept their puffy sweaters.

As we completed data collection phase, Dr. Shaikh trained me on data entry and two research assistants explained data analysis for the first wave. I finished data entry with another research assistant and had preliminary results by the end of 2019. Unfortunately, I had to go back home for a year before continuing my MPH degree. Upon returning to Crossroads to Health, we designed and deployed a second follow-up survey in March 2021. We are currently collecting data on dietary patterns and physical activity changes before and during COVID-19 pandemic lockdown. It was a bit challenging to reach out to students who graduated, and their contact email address is currently invalid, but RSPH students creates a Facebook page for every batch of international students and we managed to contact some students through this method.

VIII. *Appendix 1:*

Table 9.: Weekly Consumption (times/week) of Foods and Beverages Among International Students While in Their Home Country (W0) vs. After 3 to 6 Months (W1) of Relocating to The U.S.

Food Item	***W0[(7)]***	***W1[(7)]***
Breads and cereal(M)	4.9 (4.1-5.8)	4.9 (4.1-5.7)
Grains (1)(M)	4.8 (4.2-5.4) *	3.7 (3.1-4.3) *
Legumes and pulses (M)	2.0 (1.5-2.5)	1.3 (0.9-1.6)
Dairy	4.8 (4.2-5.4) *	4.6 (3.9-5.2) *
Eggs	3.6 (3.0-4.1)	3.3 (2.7-3.9)
Meat (2)(M)	7.7 (6.5-8.9)	6.5 (5.6-7.4)
Fruits(M)	4.4 (3.9-4.9)	3.2 (2.7-3.8)
Vegetables (3)	9.9 (8.9-11.0)	6.9 (5.9-7.9)
Sweets (4)(M)	5.5 (4.6-6.5)	5.3 (4.3-6.3)
Fats (5)	4.2 (3.6-4.9)	3.31 (2.70-3.92)
Juice	1.64 (1.2-2.1)	1.43 (0.94-1.91)
Tea or coffee(M)	4.1 (3.3-4.8)	3.73 (3.06-4.41)
Soft drinks	1.1 (0.8-1.4)	1.49 (1.08-1.91)
Alcohol(M)	0.85 (0.53-1.2)	1.01 (0.71-1.34)
Nuts	1.84 (1.33-2.35)	1.43 (0.95-1.89)
Savory Snacks(M)	1.2 (0.9-1.5)	1.7 (1.26-2.1)
Soup	2.1 (1.6-2.6)	0.93 (0.65-1.2)
Pizza and Burger	0.58 (0.45-0.72)	1.07 (0.84-1.29)
Fermented food	0.44 (0.2-0.7)	0.42 (0.18-0.66)
Diet Diversity score (range 0-26) (6)	23.8	22.5

**P-value <0.05 when comparing frequencies between W0 and W1 using Chi-square, Fisher's exact and Monte Carlo estimate.*
(1) Grains include Rice/roti/quinoa/couscous
(2) Meats include pork, lamb, poultry, and seafood
(3) vegetables include green leafy vegetables, roots and tubers like potato.
(4) sweets include honey, sweet snacks sugar and desserts.
(5) Fats include butter, oil and ghee.
(6) Diet Diversity Score (DDS) was calculated by providing a score of 1 if the person consumed the food item and 0 if he or she did not consume each food group and summing the scores for the 26 food groups in the FFQ. The diet diversity score ranged from 0 to 26.
(7) values: mean (95% CI)
(M) Missing Frequency: Bread and Cereal (W1: 1), Grains (W0:1), Legumes (W0:1), Meat (W0:2), Fruits (W1:1), Sweets (W0:1), Tea and Coffee (W0:1), Alcohol (W0:3), Savory Snacks (W1:4).

IX. Appendix 2:

Table 10. International Students' food consumption frequencies at home countries and after 3 to 6 months of Relocation.

Food Item	Baseline consumption % (n)						Follow-up consumption % (n)					
	Every day	*Few times a week*	*Once a week*	*Few times a month*	*Once a month*	*Never*	*Every day*	*Few times a week*	*Once a week*	*Few times a month*	*Once a month*	*Never*
Cereals	12% (9)	32.0% (24)	8.0% (6)	18.8% (14)	12.0 % (9)	17.3% (13)	10.8% (8)	35.1% (26)	13.5% (10)	20.3% (15)	5.4% (4)	14.9% (11)
Rice	52.7% (39)	33.8% (25)	6.8% (5)	4.1% (3)	1.4% (1)	1.4% (1)	34.7% (26)	37.3% (28)	12.0% (9)	12.0% (9)	1.3% (1)	2.7% (2)
Bread	22.7% (17)	36.5% (27)	17.3% (13)	16.0% (12)	6.8% (5)	1.4% (1)	20.0% (15)	41.3% (31)	13.3% (10)	17.3% (13)	4.0% (3)	4.0% (3)
Beans	12.0% (9)	24.0% (18)	28.0% (21)	26.7% (20)	5.3% (4)	4.0% (3)	2.7% (2)	21.3% (16)	25.3% (19)	26.7% (20)	6.8% (5)	17.2% (13)
Dairy	53.3% (40)	33.3% (25)	4.0% (3)	5.3% (4)	1.3% (1)	2.7% (2)	49.3% (37)	30.6% (23)	6.8% (5)	10.7% (8)	-	2.7% (2)
Eggs	29.3% (22)	46.7% (35)	14.7% (11)	2.7% (2)	2.7% (2)	4.0% (3)	28.0% (21)	37.3% (28)	14.9% (11)	10.6% (8)	8.% (6)	1.3% (1)
Meat	39.7% (29)	23.3% (17)	9.7% (7)	10.9% (8)	-	16.7% (12)	25.3% (19)	42.7% (32)	8.0% (6)	6.8% (5)	4.0% (3)	13.3% (10)
Chicken	16.0% (12)	52.0% (39)	16.0% (12)	5.3% (4)	-	10.7% (8)	13.5% (10)	52.7% (39)	10.8% (8)	10.8% (8)	1.4% (1)	10.8% (8)
Seafood	-	24.3% (18)	22.9% (17)	27.0% (20)	12.2% (9)	13.5% (10)	-	5.4% (4)	31.1% (23)	21.6% (16)	17.6% (13)	24.3% (18)
Fruits	40.0% (30)	50.7% (38)	4.0% (3)	2.7% (2)	2.7% (2)	-	21.6% (16)	51.3% (38)	10.8% (8)	9.5% (7)	4.1% (3)	2.7% (2)
Juice	6.7% (5)	29.3% (22)	12.0% (9)	30.7% (23)	13.3% (10)	8.0% (6)	9.3% (7)	16.0% (12)	13.3% (10)	24.0% (18)	10.6% (8)	26.7% (20)
Veggies	38.7% (29)	45.3% (34)	12.0% (9)	4.0% (3)	-	-	28.0% (21)	33.3% (25)	20.3% (15)	13.3% (10)	4.0% (3)	1.3% (1)
Roots	14.7% (11)	62.7% (47)	14.7% (11)	8.0% (6)	-	-	4.0% (3)	41.3% (31)	24.0% (18)	22.6% (17)	4.0% (3)	4.0% (3)
Other veggies	8.0% (6)	62.7% (47)	18.7% (14)	5.3% (4)	1.3% (1)	4.0% (3)	4.0% (3)	38.7% (29)	24.0% (18)	21.3% (16)	4.0% (3)	8.0% (6)
Nuts	12.0% (9)	22.6% (17)	13.3% (10)	35.1% (26)	10.8% (8)	6.8% (5)	9.3% (7)	13.3% (10)	20.0% (15)	26.7% (20)	13.3% (10)	17.3% (13)
sweet snacks	2.7% (2)	25.3% (19)	25.3% (19)	28.0% (21)	13.3% (10)	5.3% (4)	8.0% (6)	22.7% (17)	21.3% (16)	33.3% (25)	10.6% (8)	4.0% (3)
Desserts	-	24.0% (18)	20.3% (15)	32.4% (24)	22.6% (17)	1.3% (1)	5.3% (4)	17.3% (13)	21.3% (16)	28.0% (21)	16.0% (12)	12.0% (9)
Butter	50.7% (38)	16.0% (12)	12.2% (9)	12.2% (9)	8.0% (6)	1.3% (1)	29.3% (22)	34.7% (26)	18.6% (14)	5.3% (4)	1.3% (1)	10.6% (8)
Honey	29.3% (22)	24.3% (18)	16.0% (12)	16.0% (12)	9.3% (7)	5.3% (4)	20.0% (15)	24.0% (18)	16.0% (12)	16.0% (12)	4.0% (3)	20.0% (15)
Pizza and burger	-	4.0% (3)	20.0% (15)	37.3% (28)	33.3% (25)	5.3% (4)	-	18.6% (14)	29.3% (22)	36.0% (27)	10.6% (8)	5.3% (4)
Soup	10.8% (8)	36.0% (27)	12.0% (9)	20.0% (15)	18.7% (14)	2.7% (2)	1.3% (1)	14.6% (11)	26.7% (20)	13.3% (10)	25.3% (19)	18.6% (14)
Savory snacks	2.7% (2)	20.3% (15)	22.3% (17)	22.3% (17)	24.3% (18)	6.8% (5)	5.3% (4)	30.7% (23)	21.3% (16)	24.0% (18)	12.0% (9)	6.8% (5)
Tea or coffee	50.7% (38)	10.7% (8)	8.0% (6)	16.0% (12)	6.8% (5)	8.0% (6)	40.0% (30)	26.7% (20)	6.6% (5)	9.3% (7)	4.0% (3)	13.3% (10)
Soft drinks	2.6% (2)	22.6% (17)	6.7% (5)	24.0% (18)	29.3% (22)	14.7% (11)	5.3% (4)	28.0% (21)	20.0% (15)	14.7% (11)	12.0% (9)	20.0% (15)
Alcohol	2.7% (2)	10.8% (8)	17.6% (13)	14.9% (11)	31.1% (23)	22.9% (17)	1.3% (1)	21.3% (16)	14.6% (11)	16.0% (12)	20.0% (15)	26.6% (20)
Fermented food	1.3% (1)	5.3% (4)	6.7% (5)	17.3% (13)	13.3% (10)	56.0% (42)	1.3% (1)	5.3% (4)	5.3% (4)	17.2% (13)	12.0% (9)	58.7% (44)

X. Appendix 3:

Table 11. Frequency of physical activities International Students' engaged in home country and after 3 to 6 months of relocation to the U.S.

Physical activity	**Baseline activity % (n)**						**Follow-up activity % (n)**					
	Every day	Few times a week	Once a week	Few times a month	Once a month	Never	Every day	Few times a week	Once a week	Few times a month	Once a month	Never
Walking	60.0% (45)	29.3% (22)	6.6% (5)	2.7% (2)	-	1.4% (1)	66.2% (49)	27.0% (20)	2.7% (2)	2.7% (2)	1.4% (1)	-
Running	6.6% (5)	29.7% (22)	14.6% (11)	21.3% (16)	8.0% (6)	20.3% (15)	1.3% (1)	18.6% (14)	17.3% (13)	18.6% (14)	12.0% (9)	32.0% (24)
Yoga	1.3% (1)	10.6% (8)	4.0% (3)	5.3% (4)	10.8% (8)	68.0% (51)	-	6.8% (5)	4.1% (3)	9.3% (7)	5.4% (4)	74.7% (56)
Football	-	2.7% (2)	4.1% (3)	5.4% (4)	8.1% (6)	78.6% (59)	1.3% (1)	2.7% (2)	-	-	5.3% (4)	90.6% (68)
Basketball	-	1.3% (1)	-	4.1% (3)	5.3% (4)	89.2% (67)	-	1.3% (1)	-	1.3% (1)	2.7% (2)	94.6% (71)
Tennis	1.3% (1)	1.3% (1)	-	8.1% (6)	14.6% (11)	74.7% (56)	-	5.4% (4)	-	6.8% (5)	6.8% (5)	81.1% (61)
Hiking	-	1.3% (1)	1.3% (1)	6.6% (5)	29.3 (22)	60.0% (45)	1.3% (1)	1.3% (1)	1.3% (1)	13.3% (10)	24.0% (18)	58.6% (44)
Swimming	-	6.6% (5)	5.3% (4)	8.1% (6)	24.0% (18)	56.0% (42)	1.3% (1)	5.3% (4)	-	5.3% (4)	5.3% (4)	82.6% (62)
Biking	8.1% (6)	12.0% (9)	2.7% (2)	17.3% (13)	17.3% (13)	42.7% (32)	2.7% (2)	5.3% (4)	4.0% (3)	8.0% (6)	1.3% (1)	78.6% (59)
Dancing	1.3% (1)	5.3% (4)	4.% (3)	14.7% (11)	14.7% (11)	60.0% (45)	-	6.7% (5)	2.7% (2)	13.5% (10)	6.7% (5)	70.3% (52)
Household cleaning	17.3% (13)	17.3% (13)	22.6% (17)	21.3% (16)	13.3% (10)	8.1% (6)	10.7% (8)	16.2% (12)	28.0% (21)	28.0% (21)	8.0% (6)	9.3% (7)
Volleyball	-	-	-	-	4.0% (3)	96.0% (72)	-	-	-	-	-	100% (74)
Weight exercise	2.7% (2)	22.6% (17)	9.3% (7)	6.8% (5)	9.3% (7)	50.0% (37)	4.0% (3)	13.3% (10)	4.0% (3)	14.6% (11)	10.6% (8)	53.3% (40)
*Other * (baseline: n=8 Follow-up: n=4)*	1.3% (1)	5.3% (4)	2.7% (2)	-	1.4% (1)	-	-	100% (4)	-	-	-	-

**Other activities include kickboxing, ultimate, skiing, squash, horse riding, Pilates and other home workouts.*

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