

## ABSTRACT

### The Impact of Dietary Acculturation and Food Availability in the Body Composition of Division I Female International Student-Athletes

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Body composition plays an important role in sports in optimizing performance in athletes. Although there is a gap in research concerning international student-athletes, international students with high levels of acculturation to the American diet were found to gain weight, increase the intake of energy-dense and highly processed foods, and decrease the consumption of fruits and vegetables in their first months in the US. In this study, previously collected body composition data was accessed, and international female student-athletes answered surveys that screened for dietary acculturation and food availability levels. Our findings indicate that fat mass (FM) increased in 83.3% of the subjects in the first six months of college, with an average of 3.01 lbs. ( $p \leq 0.05$ ). In contrast to previous studies on non-athlete international students, higher dietary acculturation increased fat-free mass (FFM) ( $p \leq 0.05$ ) in our sample. Although not statistically significant, high food availability increased both FM and FFM.

The Impact of Dietary Acculturation and Food Availability in the Body Composition of Division I  
Female International Student-Athletes

by

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A Thesis

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## DEDICATION

To my family, who encouraged me throughout my whole life and especially during my years in the United States.

To my mom and grandparents, who provided me unlimited love and support, and believed in my capability.

Mom, thank you for teaching me since early age that nothing is impossible when there is faith, purpose and hard work. Thank you for sacrificing your resources to allow me to chase my dreams. Thank you for the hours in the phone and the energetic pep talks.

Thank you for raising me to be independent, courageous and compassionate.

All that I am or ever hope to be, I owe to you.

## CHAPTER ONE

### Introduction

#### *Background*

International students who arrive in the US for higher education experience multiple challenges, such as learning a new language <sup>1</sup>, adapting to a new culture and lifestyle <sup>1</sup>, academic pressure, family responsibilities, and changes in their diet habits <sup>2</sup>. Those may lead to health issues such as anxiety, stress, sleeping disorders, confusion, and depression <sup>3</sup>. Existing research has been done with the aim of developing strategies and programs to support a positive adaptation for this population in the US <sup>4</sup>. However, there is a gap in the research literature concerning the dietary experiences of international student-athletes. In comparison to non-athletes, international student-athletes may have more challenges to overcome since they have responsibilities as athletes <sup>5</sup> in addition to expectations towards adaptation and academic success<sup>6</sup>. Therefore, the lack of information about this unique group limits the psychological and nutritional support provided to this population at the institutional level <sup>7</sup> and could lead to negative effects on athletic performance <sup>8,9</sup>.

Even with adaptation challenges, international student–athletes were found to have the highest mean scores for overall and academic adjustment to college in comparison to nonathletes or domestic student-athletes<sup>7</sup>. This unique group, who is often motivated by scholarships and opportunities to improve their athletic and academic performance, is usually academically well-prepared<sup>7</sup> and pursues excellence in higher

education institutions in the U.S <sup>6</sup>. Among all three divisions within the National Collegiate Athletic Association (NCAA), Division I institutions have the largest enrollments of international student-athletes<sup>6</sup> and the largest athletic budgets to provide nutritional resources in addition to the greatest scholarship opportunities <sup>10</sup>. The latest statistics indicate that 10,761 international student-athletes participated in college sports at Division I institutions during the 2016-2017 academic year <sup>6</sup>, which accounts for around 56% of the total number of international student-athletes within all divisions of the NCAA. Although international student-athletes do not account for a large percentage of the total population of student-athletes in the US, the population is growing and is particularly high in certain sports <sup>6</sup>, such as tennis, ice hockey, skiing, squash, golf, field hockey, soccer, water polo and basketball <sup>11</sup>. As a result, they bring extra benefits to institutions <sup>12</sup> by enhancing cultural diversity and athletic achievement<sup>3</sup>. Therefore, it is meaningful to focus on international student-athletes and their food environment at Division I institutions <sup>6</sup>.

Although international students bring cultural diversity to institutions, immigration exposes them to a new food supply and ingredients. This results in decreases in the consumption of the traditional foods from their native countries <sup>13</sup>. Consequently, dietary acculturation occurs, which is the multidimensional, dynamic and complex process that results from members of a minority group adopting the eating patterns and food choices of the host country <sup>13</sup>. Though levels of dietary acculturation can vary, immigration to the US is usually accompanied by increased exposure to lifestyle-related risk factors and unhealthful dietary intake <sup>14</sup>. A trend toward bicultural food consumption

<sup>15</sup>, and consequently higher levels of acculturation to the American diet is positively associated with the length of residence in the US<sup>1</sup>. Additionally, adapting to US lifestyle habits can increase serum cholesterol levels, blood pressure, and chronic stress<sup>16</sup>, which may contribute to increased future risk for chronic disease and obesity.

Increased levels of acculturation to the American diet are associated with increased intake of energy-dense, fried and highly processed foods<sup>16</sup>, saturated fat<sup>15</sup>, refined grains<sup>17</sup>, and added sugar<sup>1</sup>. In contrast to the diets of their home countries, international students were found to decrease the consumption of whole grains, legumes, fruits and vegetables<sup>16</sup>. Also, portion sizes of food offered at fast-food restaurants and packaged products found in grocery stores in the US generally exceed standard portion sizes defined by the United States Department of Agriculture (USDA) and the US Food and Drug Administration (FDA)<sup>18,19</sup>. Overall, immigrants who move to the US typically have a higher consumption of meats, sugar, salt, cereals, bread, dairy, soda beverages, snacks, and desserts<sup>16</sup>. Additionally, it was reported that the most common American foods consumed by international students were burgers, pizza, ice cream, mashed potatoes, and French fries, as well as carbonated sugar-sweetened beverages<sup>2</sup>.

In addition to increased intake of energy-dense foods, high dietary acculturation levels were also positively correlated to weight gain in international students. According to Almohanna et al.<sup>2</sup>, sixty-eight percent of international students from different nationalities gained weight during their first 12 weeks after arriving in the US. It was also reported that women (n=18) gained an average of 4lbs. in comparison to men (n=17), who gained an average of 0.55 lbs. Furthermore, Muramatsu and Harmer<sup>20</sup> reported that female Japanese international students presented an average increase of 6.05 lbs. in

comparison to men, who gained 5.55 lbs. in their first six months in the US. Those findings indicate that weight gain is possible within the first few months of arrival and may continue the longer the international student stays in the US, especially in the female population <sup>2</sup>. Additionally, a pattern of decline in physical activity, cooking and consumption of native diets, accompanied by shifts towards increased consumption of fast food items, dining out, skipping meals, and replacing it with snacks was reported, indicating a susceptibility to poor food choices.

While poor dietary practices can hinder the quality of physical training, recovery and the overall health of an athlete, the setting where athletes acquire food, such as campus dining halls, food courts, etc., can influence dietary choices and behavior <sup>21</sup>. Increased access to less nutritious foods that were unavailable or unaffordable in an immigrants' home country in addition to a wider variety of attractively-packaged processed foods, restricted access to traditional ingredients and foods, and college feeding programs that reprogram students palates to prefer traditional "American" foods are potential contributors to weight gain <sup>2</sup>. Therefore, the effect of students' choices could vary according to peer pressure and availability <sup>16,21</sup>.

The perceived food environment and (budget-friendly) access influences the food and beverage choices of athletes and any additional barriers or opportunities for consumption of a nutritious diet<sup>22</sup>. In contrast, several students agreed that the buffet-style in the campus cafeteria influences increased food intake, which has led to weight gain <sup>16</sup>. This was also seen with athletes who reported overeating in dining halls due to the abundance of options and the habit of returning to the food line for second servings after observing teammates eat food that looked appealing <sup>21</sup>. According to a previous

study, eating in “all-you-can-eat” dining halls accounted for 20% of the variance of weight gain in freshman college students, while meal frequency, and the increased consumption of energy-dense snacks and “junk food” accounted for 47%<sup>23</sup>. Therefore, frequent consumption of high-calorie snack foods contributes significantly to the daily caloric intake of adolescents and young adults<sup>24</sup>, which may also result in changes in body composition.

Body composition is an important factor in optimizing performance in athletes<sup>25</sup>. Considering that the impact of small but consistent deviations from energy balance, on the order of 1-2% of daily energy intake, can promote large long-term changes in body mass<sup>26</sup>, concerns about weight and body image are strong influences on food choice. Although research in international student-athletes is lacking, it was reported that by increasing body fat, Mexican American college women experience negative body image and low self-esteem, and consequently, had increased risk in engaging in disordered eating and weight control behaviors<sup>27</sup>

Although athletes have the same risk for disordered eating than non-athletes, athletes may progress to a more severe stage due to strenuous exercise and a more severe caloric restriction<sup>28</sup>. In addition, sport pressures contribute uniquely in explaining female athlete's body dissatisfaction, dietary intent, and bulimic symptoms, suggesting that they are a unique feature for female athletes in comparison to general sociocultural pressures<sup>29</sup>. Therefore, international student-athletes who are dissatisfied with their bodies may engage in unhealthy dietary behaviors to achieve physique and body weight goals, particularly if they participate in sports that encourage attainment of a lean physique<sup>29-31</sup>.

Furthermore, women are particularly targeted for screening for disordered eating<sup>32</sup> and calorie restriction behaviors due to the prevalence of eating disorders in the female population<sup>33</sup>. In regard to athletes, previous research indicates that the perception of gaining weight may lead female athletes to delay immediate gratification for foods associated with weight gain more so than their male counterparts<sup>34</sup>. In addition, women have the risk of developing the female athlete triad, a combination of pathological weight control measures and hormonal disturbances, which can lead to serious consequences not only in sports performance but also in long-term health<sup>35</sup>. Considering these findings, it was meaningful to focus on female international student-athletes for this study.

Division I athletes are often misinformed about nutrition, consume diets of limited variety, and unnecessarily restrict their dietary intake. Those factors can lead to under fueled athletes who are preoccupied with thoughts of food, perform poorly, and are at increased risk of injury<sup>36</sup>. By restricting their caloric intake without professional guidance or engaging in disordered eating behaviors, athletes increase their risk of compromised immunity, bone mineral and muscle loss, delayed healing, menstrual dysfunction, and cognitive deficits<sup>36</sup>.

In contrast to this reality, an athlete who is well nourished is not only healthy but typically capable of training and competing more intensely, as well as being less susceptible to injury and fatigue<sup>37</sup>. In addition to ensuring that athletes meet their caloric needs and fuel properly, regular contact and support from Sports Registered Dietitians (RDs) was found to improve diet quality and to have beneficial effects on body composition<sup>25</sup>. Therefore, considering the need for further research on international college-athletes and their dietary experiences transitioning to the American diet, the

purpose of this study was to investigate the impact of dietary acculturation levels and increased food availability on the body composition of Division I female international student-athletes from Baylor University. We hypothesized that elevated levels of dietary acculturation and increased food availability provided by athletic facilities will negatively affect the body composition of international student-athletes by increasing overall body fat mass.

### *Rationale*

We hypothesized that high levels of dietary acculturation and food availability correlate with higher body fat mass. If a correlation is found, then a case can be made for the need to provide better strategies and additional support for international student-athletes regarding the nutrition composition of common American foods and adequate portion sizes, as well as guidance concerning their food and snack availability. Increased focus on this population may lead to a smoother dietary adaptation to the new American college environment, which could influence their athletic and academic performance. Therefore, student-athletes may be better able to increase energy levels, optimize performance and improve overall health, as well as decrease their risk of developing a negative body image, disordered eating patterns and extreme caloric restriction as probable consequences of body composition dissatisfaction.

### *Objectives*

- (1) Assess and compare levels of dietary acculturation
- (2) Identify potential associations of dietary acculturation scores to diet quality scores, fat and fat-free mass change over time



(3) Assess and compare levels of food availability

(4) Identify potential associations of food availability scores to diet quality scores, fat and fat-free mass change over time

## CHAPTER TWO

### Materials and Methods

#### *Selection and Recruitment*

Female international student-athletes who were currently enrolled at Baylor University were recruited for this study. The target population was full-time, Baylor University (BU) undergraduate and graduate female international student-athletes who either have or have not resided in the US prior to attending Baylor University, were participating regularly in a Division I sports and were physically present and enrolled at the university for at least 3 months. All the participants were 18-25 years old. Exclusion criteria were male international student-athletes, students who had a long-recovery post-surgery (longer than 2 months) or invasive procedure in the past 3 months or were pregnant. Only female college students were recruited because of the predominance of eating disorders and the impact of appearance-related sports in women as compared to men. The participants received the study invitation by email and in English, and then received the consent form by email from *Adobe Sign* 24 hours after receiving the study invitation. Approval to conduct the study was granted by the Institutional Review Board for Human Subjects (IRB), and written informed consent was received from each participant. The steps for the realization of the study are displayed below in Table 2.1.

**Table 2.1.** Study Steps

Activity	Period	Description
Athletics Approval	April 2020	Study information was sent to athletic director and sports RDs. Questions and concerns were addressed.
IRB	05/21/20 06/10/20	IRB protocol submission IRB protocol approval
Recruitment	07/01/20 - 08/04/2020	Athletes who met the inclusion criteria received emails with study information and participation request.
Consent forms and Surveys	07/02/20 - 07/24/20	24 hours after receiving initial study information, potential participants received the consent forms by email to be signed electronically (Adobe Sign). Daily reminders were sent every other weekday.
Survey responses	07/03/2020- 08/04/2020	Emails with the 2-survey links (Qualtrics and DHQ-3) were sent to participants.
DEXA	08/25/2020	Collection and codification.

*Design and Methods*

This was a cross-sectional study, using a convenience sample of female international student-athletes. Although previously collected body composition data from the participants was gathered as available, most data were collected in the form of surveys at one point in time. The participants received two links of self-administered electronic questionnaires, including the Female International Student-Athlete Questionnaire (FISAQ) and the Diet History Questionnaire (DHQ-3). The FISAQ consisted of six blocks, comprising demographics, dietary acculturation, food availability, disordered eating (FAST), plan for change and self-report. Student-athletes had the choice of answering the online surveys in English or Spanish. The data collection

tools of this research study are presented on Table 2.2. The participants took anywhere from 20 to 40 minutes to complete the FISAQ questionnaire, and from 20 to 60 minutes to complete the DHQ-3. While the DHQ-3<sup>38,39</sup> and the FAST<sup>32</sup> are standardized, validated and published surveys, five out of the six sections of the FISAQ assessment (demographics, dietary acculturation, food availability, plan for change and self-assessment) were designed by the principal investigator specifically for this research project. Questions from previously published research articles on similar topics were used as a model for the development of the survey<sup>2,6,16,40</sup>.

**Table 2.2.** Data Collection Tools

Variable	Measurements	Development
Body Composition	DEXA <ul style="list-style-type: none"> <li>○ Baseline</li> <li>○ 6 months</li> <li>○ 12 months</li> <li>○ last record</li> </ul>	Access was granted by the director of Performance Nutrition at BU
Demographics	FISAQ (Section I)	Researcher
Dietary Acculturation	FISAQ (Section II)	Researcher
Food Availability, Habits and Preferences	FISAQ (Section III)	Researcher
Disordered Eating	FISAQ (Section IV)	FAST (validated)
Plan for Change	FISAQ (Section V)	Open response
Self-Assessment	FISAQ (Section VI)	Researcher
Diet Quality (HEI-2015)	Diet History Questionnaire	DHQ-3 (validated)

### *Body Composition*

While previous studies on non-athlete international students and dietary acculturation used body weight and Body Mass Index (BMI) as measurements<sup>2,20</sup>, this study used body composition due to the importance of lean versus fat mass in competitive athletes. Body mass index and body weight (BW) can be misleading when evaluating athletes who may have high levels of fat-free mass<sup>41,42</sup>. Access to previously collected Dual-energy-X-ray absorptiometry (DEXA) scans was provided by the director of sports nutrition, as available. The body composition information collected was from any point between the first arrival at BU (baseline), 6 months, 12 months and the most recent body composition data after enrollment. Body weight, body fat percentage, body fat mass and fat-free mass were collected for each time period for inclusion in the final analysis.

### *The Female International Student-Athlete Questionnaire (FISAQ)*

*Survey validation.* Although the survey questions of this study were not tested for reliability, they were tested for face and content validity prior to the beginning of the study in a smaller sample of female international student-athletes (n=13). From this sample, 7 were current Baylor international student-athletes, 3 were former Baylor student-athletes and 3 were former international student-athletes from different Division I universities across the US. The students were asked to provide survey feedback by taking the survey and sharing any potential improvements to increase clarity or add a topic that was not covered in the survey questions. In addition, Baylor University professionals from the athletics, nutrition and psychology department reviewed the questionnaire after the student-athlete responses and provided extensive feedback. This group was composed

of Registered Dietitians (RDs), including faculty and sports RDs, athletic trainers, as well as associate athletic director and faculty at the psychology department.

*The Western-pattern diet.* After signing the consent form, the participants gained access to the Qualtrics electronic survey. With the purpose of providing context for the subjects prior to answering the survey questions, the first question of the survey provided the common general definition of a Western pattern diet or standard American diet, which is provided by Wikipedia <sup>43</sup>.

The Western pattern diet or standard American diet is a modern dietary pattern that is generally characterized by high intakes of red meat, processed meat, pre-packaged foods, butter, candy and sweets, fried foods, conventionally-raised animal products, high-fat dairy products, eggs, refined grains, potatoes, corn (and high-fructose corn syrup) and high-sugar drinks, and low intake of fruits and vegetables, whole grains, grass-fed animal products, fish, nuts, and seeds [...] By contrast, a healthy diet has higher proportions of unprocessed fruits, nuts, vegetables, and whole-grain foods. <sup>43</sup>

Following this paragraph, the participants were asked if they understood the definition of a Western diet. The participants who selected “yes” were able to proceed and start the survey.

*Demographics (part I).* This section consisted of 12 questions, in which 2 were open-ended and 10 closed ended. Information regarding the length of residence in the US, the student-athletes age, citizenship, major, year in school, sport, as well as questions about student transfer status and health conditions that may affect diet were included. Frequency, dichotomous and essay questions were used.

*Dietary acculturation (part II).* This section screened for perceived changes towards American dietary patterns and food preparation since immigration. The majority

of the existing studies using dietary acculturation scales are individual to specific nationalities, especially focused on Chinese<sup>15,44</sup>, Latinos<sup>45</sup> and Filipinos<sup>46,47</sup>. In contrast, the goal of this study was to involve student-athletes from different ethnicities and citizenships. Thus, a neutral dietary acculturation scale was developed by the primary investigator based on recommendations of a position paper published in the Journal of the Academy of Nutrition and Dietetics (JAND) to be used by all participants<sup>13</sup>. According to this position paper, there is no “gold standard” acculturation scale. The authors recommend dietary acculturation scales to scan for the adoption of the eating patterns of the host country, the maintenance of traditional diet patterns, biculturalism and the consumption of foods and patterns associated with Westernization of the diet<sup>13</sup>.

Previous studies on dietary acculturation and their data collection tools, including a study on dietary acculturation by Almohanna et. al. (2015)<sup>2</sup>, the Asian Indian Dietary Acculturation Measure (AIDAM)<sup>48</sup> and the Dietary Assessment Questionnaire of Filipino Americans (DAQFM)<sup>46</sup>, were the foundation for the development and selection of the study questions<sup>15</sup>. The survey questions covered dietary habits, such as the frequency in which subjects cook their native diets, the influence of the American diet in their food choices and changes in snacking and meal patterns<sup>16</sup>, as well as the accessibility to native ingredients<sup>48</sup>. Dining patterns, portion sizes, and consumption of specific food groups and beverages, such as fruits and vegetables, starchy foods<sup>46,48</sup>, meats, dairy, processed and fast foods, soft drinks and sugary desserts were also assessed<sup>16,46</sup>.

This section was composed of 25 closed-ended questions built as a Likert-scale, which corresponds to different levels of agreement. Out of the 25 questions, 20 were

included in the dietary acculturation variable. This variable screened for the transition between the dietary practices of international student-athletes' home country and the new dietary habits from the United States resulting in the status of (1) traditional, (2) bicultural or (3) acculturated, according to total scoring points. The participants could choose from four options, including strongly agree, somewhat agree, somewhat disagree and strongly disagree. The scorings were equivalent to 4, 3, 2 and 1 point, respectively from more acculturated (strongly agree) to less acculturated or traditional (strongly disagree). For this specific research study, having larger ranges for low and high dietary acculturation scores and shortening the biculturalism classification enabled comparison between dietary acculturation levels and additional variables. Therefore, scores between 20-49 points represented traditional diets, 50 points represented biculturalism, and 51-80 points represented acculturated dietary consumption (Table 2.3).

**Table 2.3.** Scoring Criteria for Dietary Acculturation

Variable	Scoring
Dietary Acculturation	20- 49: Traditional 50: Bicultural 51-80: Acculturated

*Food availability and preferences (part III).* This section assessed the food availability on campus, access to the grocery store, and additional food-related perceptions and preferences of student-athletes. It contained 22 closed-ended questions based on previous questionnaires that screened for food availability post-deregulation of the NCAA snack rule in 134 college athletic teams <sup>49</sup>. The questions varied between dichotomous, multiple-choice and 5-point-Likert scale.



From this section, the Food Availability variable was created, which consisted of 5 questions. The questions included the quantity of snacks selected during the day as “grab and go” style, fruit and vegetable accessibility, meal plan enrollment on campus, as well as the food availability and the tendency of getting second servings or larger portions in the dining halls in comparison to when they were in their home countries. For scoring purposes, Likert scale answers were combined to agree and disagree only. Therefore, “yes” or any variations of “agree” scored two points, while “no” or any variations of “disagree” scored zero points. In addition, the number of snacks accounted for zero (no snacks), two (1-3 snacks per day) or four (3-6 snacks per day) points. To be classified with high food availability (5-12 points), athletes needed to agree with at least three out of the five food availability sentences.

In addition, accessibility to the local grocery store was screened by two questions, including owning a car for transportation to the grocery store and the frequency of monthly visits. Frequency accounted for rarely (0 points), 2-3 times per month (3 points) or weekly (4 points), while having a car accounted to “yes” (2 points) or “no” (0 points). To be classified with grocery store access (3 or more points), athletes needed to have at least three points, and therefore, agree to go to the grocery store at least 2-3 times a month.

Additionally, snack frequency was screened by four questions, including overall snack frequency, late-snack frequency, pre-package food consumption and the number of snacks usually eaten each day. The scorings followed the combined “agree” and “disagree” scoring style previously used for the food availability. Athletes needed to agree with at least two out of the four snack frequency sentences to be considered to have

high snack frequency (4-13 points). The food availability scores were provided in the Table 2.4.

**Table 2.4.** Scoring Criteria for Food Availability

Variable	Scoring Classification
Food Availability on Campus	0-4: low 5-12: high
Access to Grocery Store	0-2: low 3 or more: access
Snack Frequency	0-3: low 4-13: high

*The Female Athlete Screening Tool (Part IV) and other additional variables.* The female athlete screening tool (FAST) was used to screen for disordered eating behaviors<sup>50</sup>. The original questionnaire contains 33 questions and was previously tested for reliability and has been validated<sup>32</sup>. In contrast, after receiving feedback from student-athletes and faculty, three questions of the FAST questionnaire were edited or excluded to improve clarity. The explanation “not including required warm up, regular practice and cool down” was included in the question “I participate in additional physical activity for more than 20 min in length on the days I have practice or competition”. The question “I do not eat foods that have more than 3 grams of fat” and “I strive for perfection in all aspects of my life” were excluded from the questionnaire. According to the student-athletes, perfectionism is relative and probably a “must-have” for many college athletes.

The scorings for disordered eating were adjusted based on the number of questions excluded from the original FAST questionnaire. Many athletes explained that 3 grams of fat was an extremely low amount to be considered. Additionally, the influence of cooking skills and contact with the sports RD in the body composition of international

student-athletes were also considered. The scoring possibilities for both variables were equally divided in two. Scorings at or below the median were considered low, while scorings above the median were considered high. The scorings for the additional variables are presented on Table 2.5. Those variables, including disordered eating, cooking skills and contact with sports RD were analyzed and compared to body composition change variables (fat and fat-free mass change) from four different time periods (baseline, 6 months, 12 months and most recent) with the aim of searching for potential correlations.

**Table 2.5.** Scoring Criteria for Additional Variables

Variable	Scoring (subjects)
Disordered Eating (FAST)	73-87: subclinical disordered eating >88: clinical eating disorder
Cooking Skills	0-3: Not skilled 4-6: Skilled
Contact with RD	1-3: low contact 4-6: contact

*Plan for change (part V).* Considering the variability of experiences in the process of dietary acculturation, this section consisted of three open-ended questions regarding the student-athletes experiences, takeaways and hypothetical suggestions for improvement of their dietary experiences as freshman, as well as suggestions for future international student-athletes at the institutional level. The questions included, "What did you learn from your experience transitioning to the American diet and dealing with the foods and snacks available in your new environment?"; "If you could go back in time and give advice to "Freshman You", would you provide any suggestions to ease your

transition to the American food environment and diet?", and "Do you have any suggestions you would make to improve the experience of international student-athletes at Baylor University? What would you change if you could? Feel free to comment, explain, and share your thoughts".

### *Diet History Questionnaire (DHQ-3)*

The DHQ-3 was used to determine the usual dietary intake of the subjects of this study over their past month in the US, as well as their diet quality through Healthy Eating Index scores (HEI-2015). The HEI-2015 determines compliance with the 2015-2020 Dietary Guidelines for Americans, including adequacy and moderation of 13 numeric components of different food groups. Higher scores represent better quality and alignment with the recommendations. Although the participants were not Americans, this measurement was used as the common point between different nationalities.

### *Statistical Analysis*

The data analysis was performed using SAS version 9.4 (SAS Institute, Cary, NC). Numeric variables (means and standard deviations) were calculated using the PROC MEANS function. Frequencies for categorical variables (PROC FREQ) were reported to compare subjects who resided in the US prior to enrolling at BU (US prior) versus those who did not (Non-US prior). Pearson's correlation coefficient  $r$  (PROC CORR) was used for the analysis of two continuous variables.  $T$ -tests (PROC TTEST) were performed in cases of one continuous and one dichotomous variable, and dependent-samples  $t$ -tests (PAIRED) when comparing two means. A one-way analysis of variance (ANOVA) was conducted with one continuous variable and one polychotomous

variable (PROC GLM), while the repeated-measures ANOVA (REPEATED) were used in cases where a continuous variable was measured over time. The PROC SGPLOT function generated figures. All  $p$ -values were considered significant at or below the 0.05 level.

## CHAPTER THREE

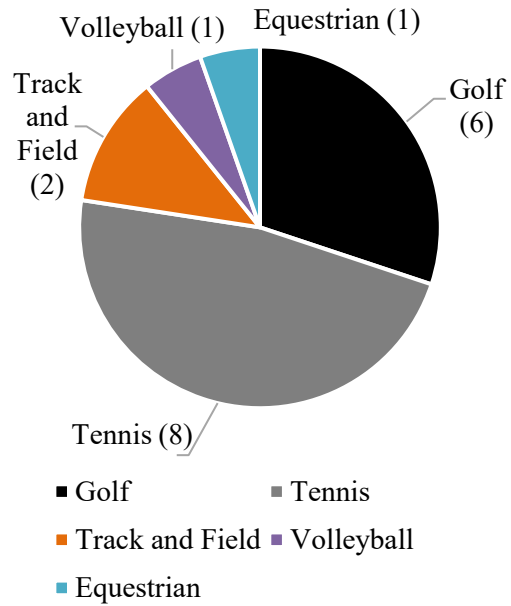
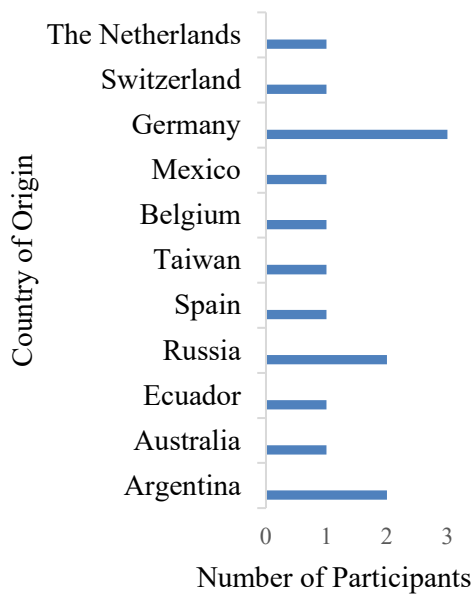
### Results

#### *Study Population*

From the sample of twenty female international student-athletes invited for study participation, eighteen of them signed the consent form and enrolled in this study. This sample had participants from eleven different countries and five different sports as presented in Figure 3.1 and 3.2, respectively. Table 3.1 summarizes each data collection tool and the number of subjects with responses. Fifteen participants (83.33%) completed the FISAQ, while thirteen of them (72.22%) answered the Diet History Questionnaire (DHQ-3). From those thirteen subjects, one individual response was removed due to incompleteness. Additionally, twelve student-athletes (66.67%) had previously collected body composition data up to six months of enrollment at BU (baseline and 6 months), nine (50%) had data up to the first twelve months (baseline, 6 months and 12 months), and seven (38.89%) had body composition information collected up to a later period (baseline, 6 months, 12 months and most recent). Sixty percent of the subjects who answered the FISAQ did not live in the US before enrolling at BU (n=9). Regardless of missing body composition, DHQ, or FISAQ, all participants were included in the data analysis when possible.

**Table 3.1.** Participant Responses

Variable	Responses
Body Composition	Baseline: 14 6 months: 12 12 months: 9 Most recent: 7
FISAQ	15
DHQ-3 (HEI-2015)	12



**Figure 3.1.** Participants per Origin (n=18)

**Figure 3.2.** Participants per Sport (n=18)

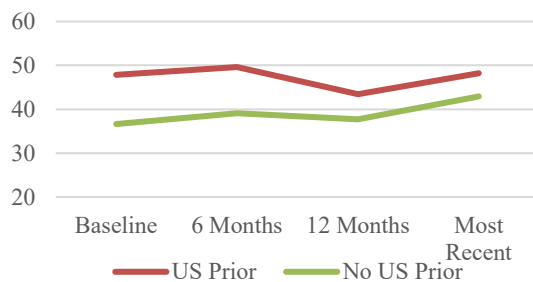
*Body Composition*

Individuals who lived in the US prior to attending BU for at least 3 months and had previously collected body composition data up to 6 months (US Prior) had a sample size of 2 (mean FM was 49.02 lbs.), while the group who did not previously live in the US (Non-US Prior) had a sample of 7 (mean FM was 33.98 lbs.). The effect of time ( $F=2.74, p=0.142$ ) and the effect of group ( $F=1.70, p=0.233$ ) were not significant. After comparing the baseline, 6-month, 12-month, and the most recent body fat mass between

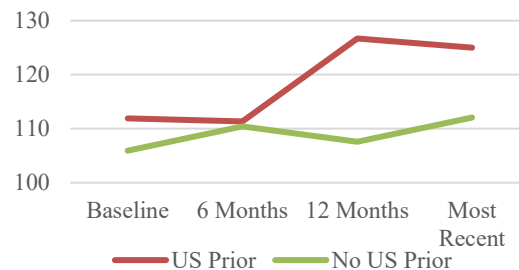
group 1 (n=1) and group 2 (n=4), the effect of time ( $F=1.31, p=0.329$ ) and the effect of time by group ( $F=0.30, p=0.825$ ) were not significant. The representation of the FM and FFM findings between groups are displayed in Figure 3.3 and 3.4, respectively.

In contrast, when adding both groups together, there was a statistically significant increase in FM from baseline to 6 months ( $n=12, \bar{x}=3.01 \pm 4.41$  lbs,  $p=0.037$ ). Ten out of twelve student participants (83.3%) increased FM, with an average of 3.01 lbs.

In contrast, those subjects gained an average of  $1.85 \pm 4.99$  pounds of FFM. However, this was no longer significant when assessing FM change from baseline to the most recent DEXA scan ( $n=7, \bar{x}=4.24 \pm 6.00$  lbs,  $p=0.111$ ). This is perhaps justified by the smaller sample size and larger standard deviation. The mean changes in total group from baseline to 12 months were  $-1.26 \pm 4.06$ ,  $p=0.378$ . In addition, the changes in total group from 6 months to 12 months were  $-0.63 \pm 2.40$ ,  $p=0.450$ . The findings of the changes in fat mass, body fat, fat-free mass and body weight data with both participant groups combined are represented in Table 3.2, 3.3, 3.4 and 3.5, respectively.



**Figure 3.3.** FM Change Over Time by US Status. FM change is represented at 4 time periods in subjects who lived in the US for at least 3 months ( $n=2$ ) in comparison to subjects who did not live in the US ( $n=7$ ) prior to BU enrollment. Overall, ten out of the twelve participants experienced significant increase in FM from baseline to six months ( $p=0.037$ ). From six months to twelve months ( $n=9$ ) and most recent ( $n=7$ ), subjects returned to their baseline levels of FM and did not present any significant FM increases.



**Figure 3.4.** FFM Change Over Time by US Status. FFM change (as measured by X) is represented at 4 time periods in subjects who lived in the US for at least 3 months ( $n=2$ ) in comparison to subjects who did not live in the US ( $n=7$ ) prior to BU enrollment. Subjects gained an average of  $1.85 \pm 4.99$  pounds of fat-free mass, but this was not statistically significant.



**Table 3.2.** Changes in FM from Baseline to Most Recent Data

Variable	N	Mean	Std Dev	Min	Max
FM Baseline	14	37.86	9.52	26.80	55.15
FM 6 months	12	38.79	8.51	27.80	51.97
FM 12 Months	9	35.93	7.43	26.60	48.50
FM Most Recent	7	40.70	7.56	30.40	50.10

**Table 3.3.** Changes in BF from Baseline to Most Recent Data

Variable	N	Mean	Std Dev	Min	Max
BF Baseline	14	26.08	5.17	19.60	35.70
BF 6 months	12	26.23	4.39	21.30	34.30
BF 12 Months	9	24.74	3.28	20.50	31.30
BF Most Recent	7	26.44	3.15	23.30	31.50

**Table 3.4.** Changes in FFM from Baseline to Most Recent Data

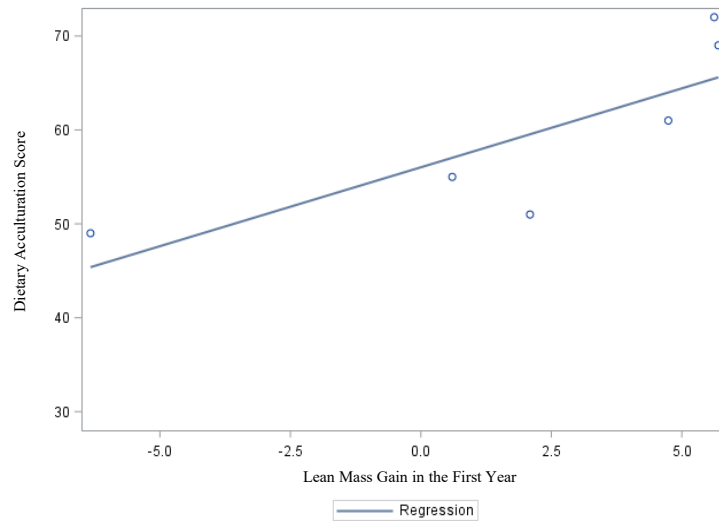
Variable	N	Mean	Std Dev	Min	Max
FFM Baseline	14	106.48	11.75	84.50	133.40
FFM 6 months	12	108.35	12.14	93.30	136.88
FFM 12 Months	9	108.11	8.60	98.60	126.70
FFM Most Recent	7	112.27	7.69	100.20	125.00
FFM Gain (first 6 months)	12	1.85	4.99	-5.18	9.81

**Table 3.5.** Changes in BW from Baseline to Most Recent Data

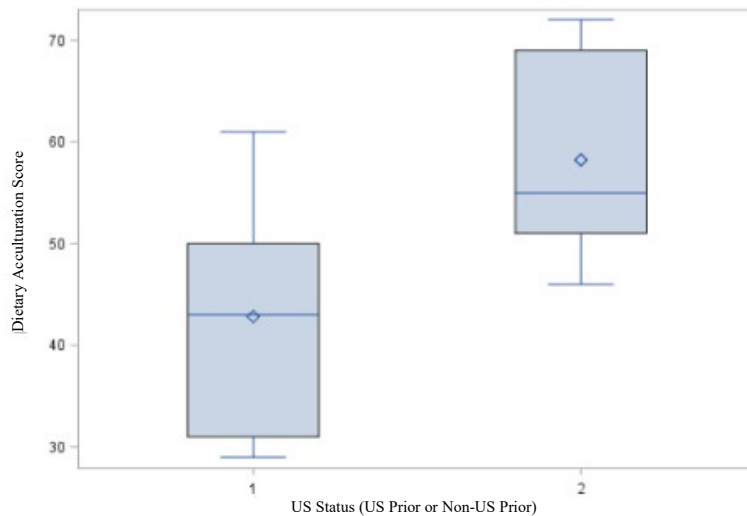
Variable	N	Mean	Std Dev	Min	Max
BW Baseline	14	144.35	14.88	115.70	166.39
BW 6 months	12	147.14	16.12	126.73	177.11
BW 12 Months	9	144.05	14.21	126.40	170.15
BW Most Recent	7	152.94	13.41	130.60	173.30

### *Dietary Acculturation*

A positive correlation ( $r=0.81$ ,  $p=0.049$ ) was found between dietary acculturation scores and FFM gain in the first year of college ( $n=6$ ). Therefore, international students who have higher dietary acculturation presented increased FFM in comparison to their counterparts who had higher maintenance of their native diet. Those findings are represented in Figure 3.5. Only two participants presented high levels of dietary acculturation ( $\bar{x}= 41.533\pm 9.47$ ). The Table 3.6 represents the most frequent answers in the scale “agree” and “disagree”. Although this study used the Likert scale and its four distinct categories (strongly agree, somewhat agree, somewhat disagree and strongly disagree) for dietary acculturation scores, the table combined the categories to provide a better understanding regarding the answer patterns and experiences from our participants. Additionally, a moderate negative association between dietary acculturation and FM was found ( $r=-0.51$ ,  $p=0.297$ ). Although that may be true, it was not statistically significant, and the study had an extreme outlier. In addition, length of stay in the US was found to be negatively correlated to dietary acculturation levels, though not statistically significant ( $r= -0.39$ ,  $p=0.149$ ). As represented in Figure 3.6, residing at BU as their first experience living in the US was correlated to higher dietary acculturation scores ( $\bar{x}= 58.22$ ), while living in the US prior to BU ( $\bar{x} = 42.833$ ) enrollment was correlated to lower dietary acculturation levels ( $p=0.019$ ).



**Figure 3.5.** Dietary Acculturation Scores vs. FFM Change in the First Year. The figure represents dietary acculturation scores (as measured by X) according to lean mass gain in the first year (n=6). Individuals with higher dietary acculturation scores presented increased lean mass gain in comparison to individuals with lower dietary acculturation levels (p=0.049).



**Figure 3.6.** Dietary Acculturation Scores vs. US Status. The figure represents dietary acculturation scores (as measured by X) of subjects (n=6) who lived in the US for at least 3 months in comparison to subjects who did not live in the US prior to BU enrollment. The group who did not live in the US (group 2) presented higher levels of acculturation ( $\bar{x}=58.22$ ) to the American diet in comparison to the group who lived in the US ( $\bar{x}=42.833$ ) prior BU enrollment.

**Table 3.6.** Dietary Acculturation Responses

Statement	Mode (Frequency)
While in the US, I often cook traditional foods from my home country.	Disagree (0.60)
The standard American diet has influenced my food choices, buying and/or cooking patterns.	Agree (0.87)
I believe I am shifting to a standard American diet.	Agree (0.67)
I eat more potatoes, bread, pancakes, pasta and/or corn now that I am in the US than I did in my home country.	Agree (0.53)
I eat more protein-rich foods that include but are not limited to processed meat, lean meat cuts (red meat, chicken, fish, deli meat), eggs, protein bars and dairy now that I am in the US than I did in my home country.	Disagree (0.53)
I eat more fast foods that include but are not limited to burgers, pizza, French fries, and/or hot dogs now that I am in the US than I did in my home country.	Agree (0.60)
I eat more sweets that include but are not limited to cookies, candy, brownies and/or ice cream now that I am in the US than I did in my home country.	Agree (0.60)
I eat <u>less</u> fruits in my diet now that I am in the US than I did in my home country.	Disagree (0.67)
I eat <u>less</u> vegetables in my diet now that I am in the US than I did in my home country.	Disagree (0.73)
I find myself snacking more often now that I am in the US than I did in my home country.	Disagree (0.60)
I skip more meals now that I am in the US than I did in my home country	Disagree (0.67)
I eat more pre-packaged foods and/or snacks now in the US than I did in my home country.	Agree (0.53)
I eat more late-night snacks now in the US than I did in my home country.	Agree (0.53)
I drink more soft drinks and/or sugar sweetened beverages now that I am in the US than I did in my home country.	Agree (0.53)
I drink more milk and/or eat more dairy now that I am in the US than I did in my home country.	Disagree (0.67)
I eat more cereal now that I am in the US than I did in my home country.	Agree (0.53)
Other than campus dining halls, I eat out more frequently now that I am in the US than I did in my home country.	Agree (0.67)
I <u>unintentionally</u> gained weight during the first months after arriving in the US.	Agree (0.80)
I usually <u>unintentionally</u> lose weight whenever I go back to my home country during summer and winter breaks.	Agree (0.73)
I have a hard time finding and/or buying ingredients/foods from my country in the US.	Agree (0.73)

*Food Availability, Access to Grocery Store and Snack Frequency*

Although not statistically significant, food availability scores presented a small positive correlation with fat mass gain ( $R=0.47$ ,  $p=0.351$ ,  $n=6$ ) and with fat-free mass gain in the first year ( $R=0.23$ ,  $p=0.666$ ,  $n=6$ ). Therefore, student-athletes with higher food availability scores were more likely to increase both fat mass and fat-free mass.

**Table 3.7.** Food Availability, Grocery Store Access and Snack Frequency Responses

Variable	Statement	Mode (frequency)
Food Availability on Campus	Do you have a meal plan on campus?	Yes (0.93)
	I have more access to food and snacks at the athletic and dining facilities at Baylor than I used to have in my home country.	Agree (0.73)
	I have access to enough fruits and vegetables to have a healthy diet.	Agree (0.93)
	I tend to get second servings or large portions when I eat at the BANC in comparison to my home country.	Agree (0.53)
	How many snacks do you usually get from fueling stations every day?	1-3 (0.80)
Grocery Store Access	Do you have a car that provides you transportation to a grocery store?	Yes (0.67)
	How often do you usually go to the grocery store to buy ingredients to cook and/or produce per month (times)?	2-3 (0.53)
Snack Frequency	I find myself snacking more often now that I am in the US than I did in my home country.	Disagree (0.60)
	I eat more late-night snacks now in the US than I did in my home country.	Agree (0.53)
	I eat more pre-packaged foods and/or snacks now in the US than I did in my home country.	Agree (0.53)
	How many snacks do you usually get from fueling stations every day? (none, 1-3, 3-6)	1-3 (0.80)

Additionally, snack frequency represented a negative correlation to access to the grocery store ( $r=-0.48$ ,  $p=0.068$ ,  $n=15$ ), which means that athletes with higher snack frequency were more likely to have less trips to the grocery store in comparison to their counterparts that snacked less frequently. Snack frequency and fat-free mass presented a positive correlation ( $r=0.77$ ,  $p=0.74$ ,  $n=6$ ). The questions included in each of those variables and their most frequent responses in the dichotomous scale are displayed in Table 3.7. In this study sample, most student-athletes presented high levels of food availability on campus.

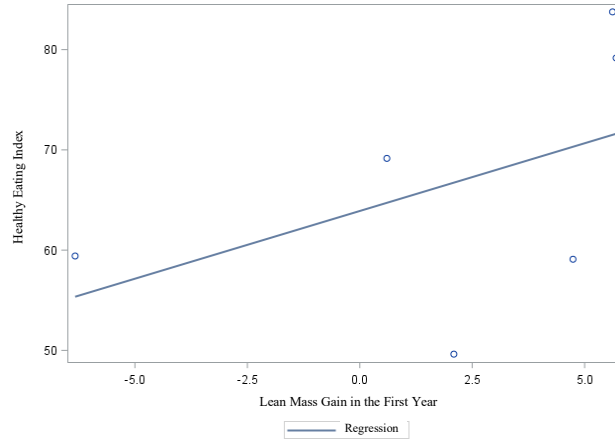
#### *Healthy Eating Scores (HEI-2015)*

Although not statistically significant, the student-athletes with higher HEI-2015 scores ( $n=7$ ) presented a greater lean mass gain in comparison to their counterparts who presented lower HEI-2015 scores ( $n=6$ ), as it is shown at Figure 3.7 . The mean score for HEI-2015 was 68.23. Student-athletes with higher HEI-2015 scores increased FFM with an average of 3.97 lbs. and an average FM gain of 0.36, while the group with lower HEI-2015 scores had increased FFM of a mean of 0.17 lbs. ( $r= 0.47$ ,  $p= 0.341$ ,  $n= 6$ ) and a mean FM gain of 4.07 lbs. ( $r= -0.62$ ,  $p=0.190$ ,  $n=6$ ). The Table 3.8 represent those study findings.

**Table 3.8** Healthy Eating Index, FFM and FM Gain in the First Year

HEI-2015	Subjects	Variable (first year)	N	Mean	Std Dev	Minimum	Maximum
Mean or below	6	FFM Gain	3	0.17	5.78	-6.33	4.74
		FM Gain	3	4.07	5.91	-0.99	10.56
Mean or above	7	FFM Gain	3	3.97	2.92	0.60	5.70
		FM Gain	3	0.36	0.58	-0.10	1.01

Healthy Eating Index (HEI-2015) mean score equals to 68.23.



**Figure 3.7.** Healthy Eating Index vs. FFM Change in the First Year. HEI-2015 scores (as measured by X) are presented according to lean mass gain in the first year of enrollment at BU. Although not statistically significant, the subjects with higher HEI-2015 scores (n=7) presented a greater lean mass gain in comparison to their counterparts, who presented lower HEI-2015 scores (n=6). The mean scores for HEI-2015 was 68.23.

**Table 3.9.** Healthy Eating Index vs. Dietary Acculturation Mean Scores

HEI-2015	Subjects	Mean Accult. Score	Std Dev	Min	Max
Below average	6	49.83	11.36	29.00	61.00
Above average	7	54.43	16.60	31.00	72.00

Healthy Eating index (HEI-2015) mean score equals to 68.23.

As presented in Table 3.9, there was a small positive correlation between participants with lower HEI and lower dietary acculturation score ( $r= 0.20$ ,  $p=0.516$ ,  $n=13$ ). Also, a small negative correlation was found between those with higher HEI and lower food availability score ( $r= -0.49$ ,  $p=0.087$ ,  $n=13$ ). Therefore, those with higher HEI-2015 scores represented higher dietary acculturation scores and lower food availability scores. In addition, there was no correlation between HEI-2015 and access to the grocery store ( $r= 0.01$ ,  $p=0.967$ ,  $n=13$ ).

### *Additional Variables*

A large negative correlation was found between cooking confidence and increased body fat mass ( $r = -0.75$ ,  $p = 0.085$ ,  $n = 6$ ). While all subjects (100%) affirmed to have the basic skills needed to cook their own meals in the US, several disagreed with the affirmation of being responsible for cooking their own meals (53.3%) and agreed (86.6%) with having someone other than themselves preparing their meals in their home countries prior to coming to the US. In addition, many subjects (60%) disagreed with the statement of feeling more confident cooking in the US in comparison to their home countries. Additionally, the scores for disordered eating from the FAST questionnaire (additional variable) were not significant for most subjects. Only one subject scored high enough to be classified into the subclinical disordered eating category. Considering that most of the participants (80%) scored high in the contact with the sports dietitian variable, our small sample size did not elicit significant results. The questions concerning the sports dietitian variable are displayed in Table 3.10.

**Table 3.10.** Contact with Sports Dietitian

Variable	Statement	Mode (frequency)
Contact with Sports Dietitian	I have talked to my sports dietitian about my diet and/or nutrition before.	Agree (0.87)
	I feel comfortable reaching out to my sports dietitian with questions about my diet and/or nutrition.	Agree (0.87)
	I had positive changes in my diet and/or nutrition after talking to my sports dietitian.	Agree (0.73)



### *Plan for Change*

Several student-athletes explained the challenges and perceptions of the American diet and the new food availability they experienced during their first months on the college campus. The answers from the participants are displayed in Table 3.11. Common themes that emerged from the open-response survey answers (n=15) were noted, and quotes were selected based on the “cut and paste” method<sup>51</sup>. Although the results of the contact with sports RDs were not significant, several student-athletes mentioned the importance of having support from these professionals during this period of transition. Other common topics of the subjects were having access to the grocery store, buying their own food and being able to cook at home as important strategies to improve their adaptation to the American diet.

In addition, the student-athletes suggested potential institutional changes. Some of them included having rides to the grocery store. According to the participants, it would be beneficial to provide rides specific for student-athletes considering that the rides from the international office are usually during practice times. Athletes also suggested having mandatory meetings with sports RDs upon arrival as well as receiving a weekly meal plans to follow. Having assistance regarding what to buy at the grocery store was also a suggestion. Team cooking sections, international dinner nights at the athletics dining hall and eating together as a team were other recommendations (Table 3.12).

**Table 3.11.** Takeaways from Transitioning to the American Diet and Food Environment, and Suggestions to “Hypothetical Freshman You”

Themes	Takeaways	Student-Athlete Suggestions
Caloric Density and Portion Sizes	<p>“Food contains more calories compared to food in my country.”</p> <p>“In the US, there are many things to try. Also, sugary and sweeter.”</p> <p>“Almost everything is high in sugar.”</p> <p>“Watch out for the hidden calories in American food.”</p> <p>“Most of the snacks were very high in calories, so I restricted them.”</p> <p>“The portions in America are so big.”</p> <p>“Oftentimes, the portion’s size from a restaurant is a lot more than I needed.”</p> <p>“Fast food is definitely not an option. The American diet is sometimes not that healthy as back home.”</p> <p>“The American diet doesn’t suit me. When the RD tells me to eat certain foods, they don’t have the same effect with me as they do with people that were raised here and are used to the food here.”</p>	<p>“Instead of eating everything, I should have stopped when I felt it was enough and take the rest at home. Take away is not really a thing back home, and when you get your plate you must finish it.”</p> <p>“During my first semester I didn’t realize the amount of food that I was eating.”</p> <p>“I would advise myself to eat more often but less in quantity.”</p> <p>“Take into consideration the amount of activity that day and eat accordingly.”</p> <p>“Enjoy American food, however, share with others or get smaller portions.</p> <p>“Just feel your body and eat when you’re hungry”.</p>
Food Availability, Grocery Stores and Cooking at Home	<p>“I ate more fast food or calorie rich food because it was so easily available.”</p> <p>“The first year everything was new, so I wanted to try everything.”</p> <p>“I learned to not be tempted for all the availability of food and snacks.”</p> <p>“I tend to snack on toast and cereal a lot, especially since I wasn’t used to having this available at home”</p> <p>“Cookies were never part of my diet before coming in America, I learn to take one sometimes but not as frequently as my freshman year”</p> <p>“The first year, it was hard to have a stable weight because all the type of food is different compare to the food in my home country. We do not have a lot of fast food, and it is rare to eat it. Going to America, nearly every weekend, we eat at least one or two fast food”.</p>	<p>“Don’t eat everything that you see.”</p> <p>“You don’t have to try every little snack that you have never tasted”</p> <p>“Talk with the dietitian and eat healthy.”</p> <p>“Start cooking your own food or deciding what you want to eat.”</p> <p>“Cook for yourself and eat at home most of the time.”</p> <p>“Make my own food using less processed products.”</p> <p>“Get a car, buy your own food and don't take the general advice given about diet, use the food plan you were on when you left your country.”</p> <p>“Go to the grocery store at home to get used to having the responsibility of cooking and buying groceries.”</p>

**Table 3.12.** Suggestions to Improve the Dietary Transition of Future International Student-Athletes

Themes	Student-Athlete Responses
Contact with Sports RD	<p>“Contact and more support by dietitians would be really helpful, give you exact examples of what you can eat.”</p> <p>“It would be great if dietitians would give you an exact weekly meal plan of what to eat.”</p> <p>“It would also help to have the Dietitian write a meal plan based on each of our nutrient needs. Sometimes we feel the pressure of coaches to eat a lot just to be fueled.”</p> <p>“I would've like mandatory meetings with the sports dietitian to keep athletes healthy, satisfied and motivated with themselves.”</p> <p>“Sometimes I feel bad asking for them even though they are very important.”</p> <p>“I do think that it might be good to do an information session on the nutrients that we are eating in America.”</p> <p>“I would say going to the grocery store with your sports dietitian and buying things.”</p> <p>“I would provide more international products so most of the athletes knew them before they arrive to Baylor and they will know better what they are taking.”</p> <p>“Talking through the food changes, it's okay to gain some weight sometimes its stress too, but you feel like it is all your fault.”</p>
Grocery Store Access	<p>“Having rides to the grocery store the first year would be helpful”.</p> <p>“Have a once a week international student ride to HEB at a time that suited everyone... the HEB trip that the international office provides is in the middle of practice.”</p> <p>“Having rides to the grocery store would be great for all athletes, thus you have people who check what you buy.”</p> <p>“Having rides to a grocery store.”</p> <p>“A lot of people don't have a car and it was a huge problem for me. None of my teammates were giving me a ride, so I had to choose less healthy options which were close to me.”</p>
Food and Team Community	<p>“Team cooking sections.”</p> <p>“Eat at the BANC with teammates.”</p> <p>“International dinner night at the BANC.”</p>

## CHAPTER FOUR

### Discussion

#### *Body Composition*

A high FM decreases movement efficiency and could therefore negatively affect athletic performance<sup>52</sup>. Fat mass significantly increased in the combined group (US and Non-US Prior) of international student-athletes in the first six months of college ( $p=0.037$ ). Although there is no existing research on dietary acculturation and body composition change in international student-athletes, these results correspond to previous findings. Previous studies reported increases in the body weight of freshman during their first semester in college<sup>23</sup>, as well as in non-athlete international students<sup>2,20</sup>. They also reported that the weight gain was particularly higher in female students in comparison to their male counterparts<sup>2,20</sup>. Those studies did not specify if weight gain was due to increased fat mass, increased fat-free mass, or both. However, odds are high that the body weight gain resulted from increased fat mass due to the decreased levels of physical activity described in existing studies in non-athlete international students<sup>2,53</sup>. Although lack of exercise will not be the case for student-athletes<sup>3</sup>, our findings demonstrate that exposure to high food and snack accessibility in the college campus and athletic facilities has the potential of leading to changes in body composition<sup>2,21</sup>.

In addition, there was no significant difference in body fat at the first year and at

the most recent follow up, which averaged from 12 to 36 months. Therefore, after the initial fat gain in the first six months, international student-athletes readjusted to return to their baseline measures of fat mass. This finding was not previously reported in the literature and we did not capture information regarding any action taken or thoughts concerning the first six months of weight gain. Considering that a high proportion of athletes use extreme weight-control methods<sup>52</sup>, our participants may or may not have purposefully adapted their diet to return to their baseline FM. In the future, nutrition education regarding the risks associated with long-term dieting and extreme caloric deficit, recommended weight loss strategies, and healthy nutrition practices should be included as part of preventive nutrition programs<sup>52</sup> for international student-athletes or student-athletes in general.

Interestingly, student-athletes who lived in the US prior to enrollment at BU did not present significant differences in body composition when compared to international student-athletes who had their first long-term contact with the American diet at BU. Although the non-US Prior group presented higher levels of dietary acculturation in comparison to their counterparts, the lack of significant differences between both groups in regards to body composition changes highlights dietary acculturation's unique impact for each person<sup>13</sup>. Therefore, due to the different dietary acculturation statuses and the individualities of each student-athlete, greater specificity in dietary interventions from sports RDs may be important to be considered when dealing with international student-athletes.

### *Dietary Acculturation*

We hypothesized that high levels of dietary acculturation would negatively impact body composition by increasing fat mass. In contrast, in addition to finding that individuals with higher levels of dietary acculturation were less likely to gain fat-mass (although not statistically significant), we found a statistically significant positive correlation between increased levels of dietary acculturation ( $r=0.81$ ,  $p=0.049$ ) and FFM gain in the first year of college. These findings oppose the literature on international students. Previous studies in Chinese immigrant women<sup>14</sup> and in non-athlete international students<sup>2,16</sup> reported a tendency between higher dietary acculturation, poor diet quality and weight gain among the majority of the subjects. Differently from those findings, we assessed HEI-2015 scores and found that individuals with higher scores of diet quality were more likely to present higher levels of dietary acculturation. Since the correlation was not statistically significant, more research is needed to further elucidate the connection between these items.

Additionally, living at least 3 months in the US prior to enrollment at BU ( $p=0.019$ ) and having a longer length of stay was correlated to lower dietary acculturation levels when compared to participants who lived in the US for the first time and had shorter lengths of stay. Those findings also oppose the results from previous studies on immigrants, in which length of residence and resulting longer exposure to the American diet was positively associated to higher dietary acculturation levels in Asian international students<sup>1</sup> and in Chinese immigrant women<sup>15</sup>. Therefore, the results of this study may be different from previous research considering the active lifestyle of international student-athletes in comparison to the decreased levels of exercise of most international students

in the US <sup>2,53</sup>. Most importantly, the food availability of our participants<sup>2</sup>, which tends to be more nutritious due to the food offerings from athletic dining halls and facilities, also needs to be considered.

In addition to physical activity and food availability, international student-athlete's social adjustment and intrinsic motivators may be different from non-athlete international students. Female athletes were found to exhibit significantly higher achievement motivation than non-athlete girls<sup>54</sup>. In addition, international student-athletes presented the highest mean scores for overall, social and academic adjustment to college in comparison to non-athlete international students<sup>7</sup>. Considering their strong social bonds with teammates, international student-athletes may create an environment more favorable to adjustment<sup>6,7</sup>. Although that may be true, the non-athlete international students from the study mentioned were primarily from Asia, while most of the international student-athletes were from North America or Europe. Therefore, international student-athletes may experience fewer cultural adjustments in comparison to their non-athlete counterparts depending on their country of origin <sup>55</sup>.

#### *Food Availability and Access to the Grocery Store*

We hypothesized that higher food availability would negatively impact the body composition of our participants by increasing FM. As a result, higher food availability was correlated to both increases in FM and FFM. To follow up with these findings, we found that higher diet quality was correlated to lower food availability scores and not correlated to access to the grocery store. Even though the subjects with higher HEI-2015 scores still had meal plans on campus, ate the snacks available in the athletic facilities and agreed that they had enough access to fruits and vegetables, they were more likely to

disagree with the statements, “I have more access to food and snacks at the athletic and dining hall facilities at Baylor than I used to have in my home country” as well as “I tend to get second servings or large portions when I eat at the BANC (Athletic Dining Facility) in comparison to my home country”. Therefore, individuals with an increased food availability, and that were more likely to get second food servings and consume larger portion sizes at the athletic dining hall in comparison to their habits in their home countries were more likely to present lower diet quality scores. Although promising, these findings were not statistically significant. Therefore, more research needs to be done to further elucidate the connection between these items.

With a nutritious food environment at the athletic facilities and the support of the sports dietitian, the international student-athletes with high dietary acculturation levels may have successfully adapted to extract the best out of the American diet. Most of the subjects of this study affirmed to have enough access to fruits and vegetables on campus (93.33%), to have more access to food and snacks at the athletic facilities than they used to have in their home countries (73%), to get from one to three snacks a day (80%), to have a meal plan at the athletic dining hall (93.33%), as well as agreed with the statement of having contact with the sports dietitian (86.66%). Although the study by Randles et al.<sup>22</sup> was conducted at smaller colleges, it was found that students who perceived their availability of fruit and vegetables as ‘always’ or ‘often’ available reported consuming fruits and vegetables more often. In addition, regular contact with a Registered Dietitian was found to improve diet quality, especially fruit and vegetable consumption among athletes, which promotes improvements in body composition<sup>25</sup>. Therefore, the support that international student-athletes receive from team sports dietitians, their access to



snacks and (potentially more nutritious) meal choice in comparison to non-athlete international students may be important aspects to consider when studying this unique group of international students.

#### *Additional Variables and Plan for Change*

In addition to the importance of food availability and snack frequency in increasing FFM, we found a large negative correlation between cooking confidence and increased body fat mass ( $r = -0.75$ ,  $p = 0.085$ ,  $n = 6$ ). These findings were not statistically significant, but we believe this may be important considering the open responses of some subjects. The responses emphasized “cooking their own food” as important for their adaptation to the American food environment. According to the responses of international student-athletes, several of them (86.66%) agreed that someone other than themselves cooked their meals and that they had structured mealtimes while living in their home countries, which may not be the case while they are living in the US.

Also, participants stated that American foods had higher added sugar and higher calories. This focus is an indication that international student-athletes were learning about the differences in the nutritional and energetic content of the new foods they have been consuming in the US in comparison to the foods from their native countries. Although students affirmed to have high contact with the sports dietitian (80%) and feel comfortable with approaching them for help (86.66%), the need of more support was still mentioned in 40% of the open response answers and suggestions for improvement. Therefore, although international student-athletes affirmed to be aware of the food they consume, they stated that having assistance and nutritional guidance upon arrival to campus may improve their dietary transition.

### *Limitations*

This study had several limitations due to its small sample size. Although eighteen out of the twenty (90%) female international student-athletes at Baylor University participated in this study, three student-athletes that signed the consent form did not complete any of the surveys, two participants who did complete the FISAQ did not complete the DHQ-3, and all of our golf student-athletes who did complete the survey did not have previously collected body composition data. Considering that several study participants did not have or completed all desired data collection, a few gaps in the data collection resulted in an even smaller sample size depending on the variables considered for analysis. In addition, the population was from only one university. The results may not be applicable in different college campuses or geographic locations, due to lower or higher food availability and services for their athletes and differences in food offerings that may affect dietary intake and food availability.

The FISAQ survey, the screening tool used for most variables of this study, was not tested for reliability, which could result in data inaccuracies. Also, considering that the dietary acculturation surveys were distributed at one point in time, the survey relied on the accuracy of the self-assessment and memory of the participants regarding their dietary habits while in their home countries. The responses may have been more accurate if the surveys were completed once the student-athlete arrived in the US and then repeated several months after arrival.

### *Recommendations for Future Research*

While international student-athletes have similar challenges in comparison to non-athlete international students, the findings of this study stress the uniqueness of this group. It is suggested that this study be repeated in other universities in other geographic regions to compare and investigate the impact of different food environments and snack availability access on body composition. We also suggest having a greater number of subjects to be able to compare lean vs. non-lean sports, as well as including male international student-athletes to compare dietary acculturation levels and body composition change. The reason for including only female international student-athletes was the predominance of eating disorders and the female athlete triad in this population. In contrast to these assumptions, most scores for disordered eating were not of either clinical or sub-clinical significance according to our adapted FAST questionnaire.

### *Conclusion*

In summary, although it is challenging to draw conclusions from many of the findings of this study due to the small sample size, the results presented have potential clinical importance. According to this study, 83.3% of the subjects increased fat mass in the first six months of college, with an average of 3.01 lbs. ( $p \leq 0.05$ ). Increased body FM may be problematic for some athletes by hindering athletic performance, as well as triggering mental health issues by not conforming to the stereotype of the lean and muscular athlete<sup>9</sup>. In addition, high levels of dietary acculturation ( $p \leq 0.05$ ) towards the American diet and snack frequency were found to be beneficial for athletes' diet quality (HEI-2015) and body composition by increasing FFM and decreasing FM gain. Cooking skills may also be important to consider, although not statistically significant.

Although the findings related to dietary acculturation opposed our hypothesis, they still highlight the importance of assistance from sports dietitians to guide the dietary transition and adaptation of international student-athletes to the American diet. Considering that dietary acculturation was found to be beneficial for the body composition of our participants, sports dietitians are essential to ensure that athletes understand how to fuel properly with what is available and do not underestimate their caloric needs due to desired weight loss<sup>52</sup>.

Consequently, it may be of importance for sports RDs to offer support and dietary education at the early transition of international student-athletes to the American diet. Examples suggested by the study subjects were providing weekly meal plans, giving more specific instructions regarding the composition of the foods offered in the athletic facilities and offering guidance at grocery stores. In addition, offering grocery store transportation specific to student-athlete schedules may also be effective. Team-bonding cooking classes and international dinners at the athletic dining hall were also mentioned. Those institutional resources would provide strategies for international student-athletes to take advantage of the nutritious foods offered in the US and the high food availability from athletic facilities. Therefore, with adequate support, international students may experience a smoother transition to the American diet, avoid unnecessary negative body composition shifts and manage to excel in athletics, academics and personal life.

## APPENDIX

## APPENDIX A

### The Female International Student-Athlete Questionnaire (FISAQ)

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#### Start of Block: Consent



1. I understand what the study is about, and my questions so far have been answered. I reviewed and signed electronically the Consent Form link sent by email, which means that I agree to participate in this study and share my body composition data. If I have any questions about the study, I know who to contact by using the information provided in the attached document.

I agree (1)

I do not agree (2)

2. Before answering the questions regarding your adaptation to the standard American diet, your food environment and dietary choices, please be aware of the definition of a Western pattern or standard American diet vs. a healthy diet (according to Wikipedia): "The Western pattern diet or standard American diet is a modern dietary pattern that is generally characterized by high intakes of red meat, processed meat, pre-packaged foods, butter, candy and sweets, fried foods, conventionally-raised animal products, high-fat dairy products, eggs, refined grains, potatoes, corn (and high-fructose corn syrup) and high-sugar drinks, and low intake of fruits, vegetables, whole grains, grass-fed animal

products, fish, nuts, and seeds [...] By contrast, a healthy diet has higher proportions of unprocessed fruits, nuts, vegetables, and whole-grain foods."

I am aware about the definition of a standard American diet. (17)

End of Block: Consent

---

Start of Block: FISAQ Section I: Demographics

FISAQ Section I: Participant Information

1. Which country do you consider as your home country? \_\_\_\_\_

*Carry Forward Displayed Choices from "What is your sport?"*



2. What is your sport?

- Equestrian (1)
- Golf (2)
- Tennis (3)
- Track and Field (4)
- Volleyball (5)
- Other (6)

3. What is your academic year?

- Freshman (1)
- Sophomore (2)
- Junior (3)
- Senior (4)
- Fifth Year + (5)



4. Is your major nutrition sciences or health related?

Yes (1)

No (2)

5. Do you consider English your native language?

Yes (1)

No (2)

6. Have you attended another university, community college, high school, elementary school or lived in the US before attending Baylor University? If yes, please include how long were you in the US for (without counting Baylor University).

Yes (1) \_\_\_\_\_

No (2)

7. If you answered "Yes" to previous question, did you live with your parents and/or guardian while in the US prior to Baylor?

Yes, I did live with my parents and/or guardian. (1)

No, but I lived with extended family. (2)

No, I came by myself. (3)

Other (4) \_\_\_\_\_

8. In the past 2 months, have you had any medical procedures, surgeries or did you manage a long-term injury?

Yes (1)

No (2)

9. During the last month you had been in the US, did you change your dietary intake because of any medical procedures, surgeries or a long-term injury? If yes, explain it briefly.

Yes (1) \_\_\_\_\_

No (2)

10. How long have you been at Baylor University?

Less than 3 months (1)

6 months (2)

6-12 months (3)

12-18 months (4)

More than 2 years (5)

11. Do you have any chronic conditions, food intolerance or food allergy that may affect your dietary intake or metabolism (diabetes, chronic kidney disease,

hypo/hyperthyroidism, celiac disease, lactose intolerance, etc.)? If you do, please specify which one. If you don't, please write "none".

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12. Is there any chance that you may be pregnant?

Yes (1)

No (2)

End of Block: FISAQ Section I: Demographics

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Start of Block: FISAQ Section II: Levels of Dietary Acculturation

FISAQ Section II: Adaptation to a Standard American Diet

1. I was responsible for cooking my own meals before coming to Baylor University.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (4)
- Strongly Disagree (5)

2. Before coming to Baylor University, my parents or someone other than myself cooked or prepared my meals.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (6)
- Strongly Disagree (7)

3. Before coming to Baylor, I had more structured mealtimes (in my home country) than in the US.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (4)
- Strongly Disagree (8)

4. While in the US, I often cook traditional foods from my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

5. I feel more confident cooking meals in the US than I did in my home country.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (4)
- Strongly Disagree (5)

6. The standard American diet has influenced my food choices, buying and/or cooking patterns.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

7. I believe I am shifting to a standard American diet.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

8. I have a hard time finding and/or buying ingredients/foods from my country in the US.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (8)
- Strongly Disagree (9)

9. I eat more potatoes, bread, pancakes, pasta and/or corn now that I am in the US than I did in my home country.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (3)
- Strongly Disagree (4)

10. I eat more protein-rich foods that include but are not limited to processed meat, lean meat cuts (red meat, chicken, fish, deli meat), eggs, protein bars and dairy now that I am in the US than I did in my home country.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (3)
- Strongly Disagree (4)

11. I eat more fast foods that include but are not limited to burgers, pizza, French fries, and/or hot dogs now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

12. I eat more sweets that include but are not limited to cookies, candy, brownies and/or ice cream now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

13. I eat less fruits in my diet now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

14. I eat less vegetables in my diet now that I am in the US than I did in my home country.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (3)
- Strongly Disagree (4)



15. I find myself snacking more often now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

16. I skip more meals now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

17. I eat more pre-packaged foods and/or snacks now in the US than I did in my home country.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (3)
- Strongly Disagree (4)

18. I eat more late-night snacks now in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

19. I drink more soft drinks and/or sugar sweetened beverages now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

20. I drink more milk and/or eat more dairy now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

21. I eat more cereal now that I am in the US than I did in my home country.

- Strongly Agree (1)
- Somewhat Agree (2)
- Somewhat Disagree (3)
- Strongly Disagree (4)

22. Other than campus dining halls, I eat out more frequently now that I am in the US than I did in my home country.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

23. I unintentionally gained weight during the first months after arriving in the US.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

24. I usually unintentionally lose weight whenever I go back to my home country during summer and winter breaks.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

25. I associate more closely with people who have a similar background (international) to me than with US citizens.

- Strongly Agree (8)
- Somewhat Agree (9)
- Somewhat Disagree (11)
- Strongly Disagree (12)

End of Block: FISAQ Section II: Levels of Dietary Acculturation

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Start of Block: FISAQ Section III: Food Availability, Habits and Preferences

FISAQ Section III: Food Availability, Habits and Preferences

1. Where do you live?

- On Campus (1)
- Off Campus (2) Do you have a meal plan on campus?
- Yes (1)
- No (2)

3. Do you have a car that provides you transportation to a grocery store?

- Yes (1)
- No (2)

4. How often do you usually go to the grocery store to buy ingredients to cook and/or produce?

- Weekly or More (1)
- 2-3 times per Month (2)
- Once a Month (3)
- Rarely (4)

5. How long would it take to you to drive to the grocery store from where you live?

- 5 minutes or less (1)
- 5-10 minutes (2)
- 10-14 minutes (3)
- 15 minutes or more (5)

6. What do you usually eat on weekdays for your main meals in addition to Bear Fuel?

(select more than one, if that is the case)

- I mainly cook all other additional meals at home. (1)
- My friends usually cook for me, or we cook together. (2)
- I eat additional meals at the BANC. (3)
- I buy additional meals from restaurants. (4)
- I use the fueling station snacks for meals. (5)

7. Where and what do you mainly eat on weekends?

- I mainly cook my own meals on the weekends. (1)
- My friends usually cook for me, or we cook together. (2)
- I usually buy meals from a restaurant. (4)
- I eat snacks from fueling stations and/or leftovers from the week. (5)

8. How many snacks do you usually get from fueling stations every day?

- None (1)
- 1-3 (2)
- 3-6 (3)
- 7 or more (4)

9. I have the basic skills needed to cook my own meals in the US (including American and/or your traditional foods).

- Agree (8)
- Disagree (9)

10. I spend more time thinking about the nutritional content of the foods I eat now in the US than I did in my home country.

- Strongly agree (8)
- Somewhat agree (9)
- Somewhat disagree (11)
- Strongly disagree (12)

11. I usually make sure I have a nutritionally balanced diet.

- Agree (1)
- Neither Agree nor Disagree (2)
- Disagree (13)

12. I enjoy the flavor of the snacks available at the fueling stations.

- Strongly Agree (8)
- Agree (9)
- Disagree (10)
- Strongly Disagree (13)



13. The snacks available at the fueling stations are nutritious.

- Strongly Agree (1)
- Agree (2)
- Disagree (3)
- Strongly Disagree (4)

14. I enjoy the taste and variety of the food at the BANC (athletic dining facility).

- Strongly Agree (8)
- Agree (9)
- Disagree (10)
- Strongly Disagree (11)

15. I have more access to food and snacks at the athletic and dining facilities at Baylor than I used to have in my home country.

- Strongly Agree (8)
- Agree (9)
- Disagree (10)
- Strongly Disagree (11)

16. The BANC usually has healthy options.

- Strongly Agree (8)
- Agree (9)
- Disagree (10)
- Strongly Disagree (11)

17. I tend to get second servings or large portions when I eat at the BANC in comparison to my home country.

- Strongly Agree (8)
- Agree (9)
- Disagree (10)
- Strongly Disagree (11)

18. Having easy access to fruits and vegetables does not increase my consumption of those foods.

- Strongly Agree (8)
- Agree (9)
- Disagree (10)
- Strongly Disagree (11)

19. I have access to enough fruits and vegetables to have a healthy diet.

Agree (8)

Disagree (9)

20. I have talked to my sports dietitian about my diet and/or nutrition before.

Agree (1)

Disagree (2)

21. I feel comfortable reaching out to my sports dietitian with questions about my diet and/or nutrition.

Agree (1)

Disagree (2)

22. I had positive changes in my diet and/or nutrition after talking to my sports dietitian.

Agree (1)

Disagree (2)

End of Block: FISAQ Section III: Food Availability, Habits and Preferences

---

Start of Block: FISAQ Section IV: The Female Athlete Screening Tool (FAST)

FISAQ Section IV: The Female Athlete Screening Tool (FAST)

1. I participate in additional physical activity (not including required warm up, regular practice and cool down) for 20 minutes or more on days that I have practice or competition.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

2. If I cannot exercise, I find myself worrying that I will gain weight.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)
- 

3. I believe that most female athletes have some form of disordered eating habits.

- Strongly Agree (1)
- Agree (2)
- Disagree (3)
- Strongly Disagree (4)

4. During training, I control my fat and calorie intake carefully.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

5. My performance would improve if I lose weight.

- Strongly agree (1)
- Agree (2)
- Disagree (3)
- Strongly Disagree (4)

6. If I got on the scale tomorrow and gained 2 pounds, I would practice or exercise harder or longer than usual.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (5)

7. I weigh myself \_\_\_\_\_.

- Daily (1)
- 2 or more times a week (2)
- Weekly (3)
- Monthly or less (4)

8 If I choose to perform an additional exercise routine on a day of competition (game/meet), I exercise for

- 2 or more hours (1)
- 45 minutes to 1 hour (2)
- 30-45 minutes (3)
- Less than 30 minutes (4)

9. If I consume alcoholic beverages, I will skip meals on that day or the following day.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never/ Not Applicable (4)

10. I feel guilty if I choose fried foods for a meal.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

11. If I were injured, I would still exercise even if I was instructed not to do so by my athletic trainer or physician.

- Strongly Agree (1)
- Agree (2)
- Disagree (3)
- Strongly Disagree (4)

12. I take dietary or herbal supplements in order to increase my metabolism and/or to assist in burning fat.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

13. I am concerned about my percent body fat.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

14. Being an athlete, I am very conscious about consuming adequate calories and nutrients on a daily basis.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

15. I am worried that if I were to gain weight, my performance would decrease.

- Strongly Agree (1)
- Agree (2)
- Disagree (3)
- Strongly Disagree (4)



16. I think that being thin is associated with winning.

- Strongly agree (1)
- Agree (2)
- Disagree (3)
- Strongly Disagree (4)

17. I train intensely for my sport so I will not gain weight.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

18. During season, I choose to exercise on my one day off from practice or competition.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

19 My friends tell me that I am thin, but I feel fat.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

20. I feel uncomfortable eating around others.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

21. I try to lose weight to please others.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

22. I limit the amount of carbohydrates I eat.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

23. If I were unable to compete in my sport, I would not feel good about myself.

- Strongly Agree (1)
- Agree (2)
- Disagree (3)
- Strongly disagree (4)

24. If I were injured and unable to exercise, I would restrict my caloric intake.

- Strongly Agree (1)
- Agree (2)
- Disagree (3)
- Strongly disagree (4)

25. In the past 2 years I have been unable to compete due to an injury.

- 7 or more times (1)
- 4-6 times (2)
- 1-3 times (3)
- No significant injuries (4)

26. During practice I have trouble concentrating due to feelings of guilt about what I have eaten that day.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

27. I feel that I have a lot of good qualities.

- Strongly agree (1)
- Agree (2)
- Disagree (3)
- Strongly disagree (4)

28. At times I feel that I am no good at all.

- Strongly agree (1)
- Agree (2)
- Disagree (3)
- Strongly disagree (4)

29. I avoid eating meat in order to stay thin.

- Strongly agree (1)
- Agree (2)
- Disagree (3)
- Strongly disagree (4)

30. I am happy with my present weight.

- Yes (1)
- No (2)

31. I have done things to keep my weight down that I believe are unhealthy.

- Frequently (1)
- Sometimes (2)
- Rarely (3)
- Never (4)

End of Block: FISAQ Section 4: The Female Athlete Screening Tool (FAST)

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Start of Block: FISAQ Section V: Plan for Change

FISAQ Section V: Plan for Change (Open response)

1. What did you learn from your experience transitioning to the American diet and dealing with the foods and snacks available in your new environment?
2. If you could go back in time and give advice to "Freshman You", would you provide any suggestions to ease your transition to the American food environment and diet?
3. Do you have any suggestions you would make to improve the experience of international student-athletes at Baylor University? What would you change if you could? Feel free to comment, explain, and share your thoughts. *Example: having more contact with the Sports Dietitian upon arrival in the US,*

*having an international dinner night at the BANC once a month, having rides to the grocery store, etc.*

End of Block: FISAQ Section V: Plan for Change

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Start of Block: FISAQ Section VI: Self-Assessment

Answer Accuracy Section VI: Self-Assessment

1. Overall, how was your experience in understanding and responding the questions of this survey (in English)?

- Easy: I was able to understand the language. (1)
  
- Neutral: I was able to respond the questions by asking for help, translating or guessing. (2)
  
- Confusing: I was not sure about the meaning of some words, which probably affected my ability to answer the questions. (3)
  
- Other (Please explain below) (4)

End of Block: FISAQ Section VI: Self-Assessment

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End of the Female Athlete Screening Questionnaire (FISAQ)



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