USPORT STUDENT ATHLETES' DIETARY HABITS AND THE IMPACT OF VARIOUS BARRIERS ON NUTRITIONAL INTAKE AND HEALTH/PERFORMANCE

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A THESIS SUBMITTED TO
THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE

GRADUATE PROGRAM IN KINESIOLOGY
YORK UNIVERSITY
TORONTO, ONTARIO

MARCH 2024

ABSTRACT

Introduction: Collegiate athletes face unique lifestyle circumstances compared to other athletic populations that can affect their daily nutrition habits. **Purpose:** To understand student-athletes (SAs) dietary habits and identify barriers faced by SAs that impact food intake. **Methods:** Cross-sectional study using an 89-question survey. **Results:** Thirty percent of SAs included in this study reported not consistently eating 3 meals per day and 46% reported being hungry before going to bed. Almost 75% of SAs reported that they were not able to access high quality food on campus and 80% reported that their daily schedule limited their ability to cook and prepare meals. More than half of SAs reported worrying about running out of food due to a lack of money. **Conclusion**: Lack of time, financial issues, and limited access to food on campus were prevalent barriers that affected nutritional intake. Collegiate SAs nutritional intake is impacted by barriers that are complicated, work in conjunction with each other and are different depending on the SA and their background.

DEDICATION

Dedicated to my wife Lindsay, to my parents Marsha and Rudy and to my brother Lawson.

Thank you for all the support, motivation, and love.

ACKNOWLEDGMENTS

This thesis project would not have been possible if not for the contributions of many different parties of people. I want to thank my supervisor Alison Macpherson and committee member Andrea Josse for the guidance and mentorship throughout this process. Michael Modica for all the assistance and advice throughout the collection process. York University's Athletics and Recreation Department for their engagement throughout this project specifically, Andrea Prieur, Nathan Groenveld, Catherine Salole, Alex Dominato, Steven Chuang and all the varsity sport coaches. Last but most importantly, the York University Lions student athletes who participated in this study.

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CHAPTER 1 - INTRODUCTION

Nutritional intake and its impact on sports performance has been a topic of interest since the late 1950s and over the last 20 years, has become a heavily researched topic. Currently nutrition is understood to be a critical aspect of athletic success.[1] Good nutrition assists in someone's ability to tolerate higher-intensity physical outputs and aids in the recovery from activity. Due to the demands placed on them, athletes involved in higher levels of sport will have increased nutritional requirements than non-athletes.[1,2]

The American College of Sport Medicine (ACSM) recommends that athletes need to increase overall fuel intake during periods of high-intensity and/or long duration training to match the increased energy expenditure from training demands.[3] The ASCM has recognized that athletes who are unable to intake enough fuel to match or exceed the demands of their training (i.e., low energy availability or LEA) can experience performance decrements and if continued over time, negative impacts on their health. [4,5]

Factors that affect nutritional intake can be complicated in different athletic populations. Depending on the age of the athlete, living situation, level of competition and available resources, barriers may exist for athletes to try and achieve adequate nutritional intake for the demands of their training. Collegiate athletes, herein referred to as student athletes (SAs), face unique lifestyle circumstances compared to other athletic populations that can affect their daily nutrition habits.[6] Canadian college students have been shown to suffer from food insecurity during their time in university.[7–9]

Canadian University (USPORTS) athletes are the one of the highest levels of competing athletes in Canada. The commitment to training and sport is extremely high, however there is limited information on the dietary habits of SAs, the barriers they face to nutrition and the impact from a health, sociocultural and economic standpoint, that this has on USPORTS SAs. Therefore, the purpose of this study is to gain an understanding of the dietary practices and common barriers to nutrition for York University SAs. The primary objective of this study was to understand York University SAs dietary habits. The secondary objective of this study was to explore the various barriers that impact these SAs' nutritional intake

(although not directly measure nutritional intake). Lastly, the third objective was to try to determine if SAs experience any health/performance symptoms related to compromised nutritional intake in their daily living. It was hypothesized that York University SAs will 1) have irregular dietary habits that may not be sufficient for optimal nutritional intake during periods of high intensity activity, 2) experience impacts to their ability to achieve optimal nutrition through barriers such as lack of time, financial issues, general nutrition knowledge and application and 3) experience some general health/performance decrements that are aligned with symptoms of LEA.

CHAPTER 2 - LITERATURE REVIEW

Nutritional Intake and Low Energy Availability

Energy availability (EA) reflects the difference between energy intake and energy expenditure. Low energy availability (LEA) occurs when either nutritional intake is too low or energy expended through exercise is too high, which can leave an insufficient amount of energy left to maintain normal biological functions.[4,5,10–12] There is limited information on the prevalence of LEA in USPORT SAs however this has been shown to occur in other athletics populations.[12,13] With respect to this thesis, while we did not directly measure EA (i.e., no direct measure of energy/nutrient intake or energy expended), we are interested in assessing the factors/barriers that can affect nutritional intake that can potentially relate to self-reported symptoms, and/or impairments in function and wellbeing of SAs. Compared to other undergraduate students, most athletes require increased nutritional/energy intake to sustain a higher level of physical activity and training. Thus, the issues of LEA and food insecurity may be more prevalent in this special population of students.

Issue with Food Insecurity in Collegiate SAs

In a study completed on NCAA div3 student-athletes (SAs; n=424) 29% of SAs reported experiencing times where they could not access food and extended periods of hunger.[14] In another study, researchers found a 14.7% prevalence of food insecurity within NCAA div3 SAs (n=787).[15] Although there is limited information about food insecurity in USPORTS SAs, Researchers have shown that Canadian University Students (non-athletes) experience food insecurity during their time in school. In 2017, a study performance on students (non-athletes) attending the University of Alberta (n=58) showed that almost 90% of the sample reported some level of food insecurity and 44.8% reported being severely food insecure.[8] Another study (n = 82) determined that 37% of undergraduate students (non-athletes) at University of British Columbia were food insecure in 2019.[9] Finally, a study (n = 1282) performed on University of Saskatchewan undergraduate students (non-athletes) found that 39.5% of students experience some food insecurity.[7] In the context of this study, if non-athlete students at Canadian Universities experience food

insecurity, it can be assumed that SAs who attend the same universities potentially could experience food insecurity as well. Food insecurity is an important consideration in USPORT SAs that can impact their health, wellbeing and performance.

Barriers to Nutrition for Collegiate SAs

Factors that affect nutritional intake can be complicated in different athletic populations. Depending on the age of the athlete, living situation, level of competition and available resources, barriers may exist for athletes to try to achieve adequate nutritional intake relative to the demands of their training. Indeed, collegiate SAs face some of the most unique lifestyle circumstances compared to other athletic populations that can impact their daily nutrition habits.[6,16] There is limited information available on the barriers that Canadian USPORT SAs face when accessing nutrition, more information on barriers that athlete face in terms of adequate nutritional intake comes from other countries.

In a study conducted on NCAA div1 athletes (n = 424) across multiple sports, SAs reported that factors such as lack of time, access to healthy food, cost of healthy food, lack of cooking skills/knowledge were the most common barriers to them eating a healthy and nutritionally adequate diet.[6] Another study performed on athletes from the Australian State Institute of Sport (n=46) identified similar barriers such as lack of time, financial limitations, inadequate cooking skills and living arrangements as factors that athletes felt prevented adequate nutritional intake.[17] Additionally, other impactful factors may include complicated/busy lifestyle, independent living (often for first time), academic demands/pressures, social demands/pressures, and high-level sport demands. [6,17–20] While there is no reason to believe that Canadian athletes are any different, more research is needed to assess this in a Canadian context.

Differences in Athletic Department Resources and USPORTS Comparisons

Although research has shown that NCAA Div1 and Div3 SAs experience food insecurity and barriers to nutrition, depending on the institutions, some SAs will have vastly different support systems

available to alleviate some of these issues. In reporting completed by the NCAA, division 1 FBS (Football Bowl Subdivision, representing the top NCAA programs) schools had a median operating cost of $78,000,000 for athletics (n=351).[21] However, comparatively NCAA div2 (n=302) and div3 (n=191) schools had median operating costs of $6,800,000 and $4,375,000 respectively.[22,23] These differences in operating costs change the ability of the institution and athletics department to provide support for SAs like scholarships, housing, support staff (nutrition/dietitian) and food (day to day, during travel/games etc.). Although limited information is available regarding the operating costs of USPORTS athletics departments, it can be assumed that most schools would operate at or below the NCAA div3 operating cost. This reality limits the ability of most USPORT schools to provide resources to support SAs health and well-being in comparison to NCAA.

CHAPTER 3 - METHODS

Participants

Current USPORTS SAs (n = 75) from a single university in Toronto, Canada participated in this study. Inclusion criteria included: 1) had to be enrolled in school and 2) had participated in sport during the 2022-23 Fall/Winter semesters. The University Human Ethics Review Committee approved all methods and procedures used in the study and all participants provided consent by signing an informed consent form to begin the online questionnaire (Appendix A).

Online Survey Outline

The 89-question survey consisted of four sections (Appendix B). The first section included 19 questions on participant demographics including age, sex, gender, sport, religious background, living arrangement, funding, work, and academic/sport commitment. The second section consisted of 22 questions on health/performance impairments that have been associated with acute or chronic states of LEA. Health impairment questions included number of doctor visits, illnesses, injuries, and performance impairment questions included fatigue, coordination, endurance, recovery, and adaptation. The third section consisted of 24 questions on dietary habits of the SAs over the last year asking what macronutrients their meals consisted of, where they got food from, how they prepared food, and when they consumed it. The last section consisted of 24 questions on potential barriers the SAs faced in relation to nutrition including nutritional knowledge, cooking ability, food access, scheduling, and financial and sociocultural implications. The first section of the survey utilized yes/no or general numeric scales for answers. The second, third and fourth sections of the survey used a 5-point Likert scale. The research group developed the survey based on the current academic literature and performed two preliminary pilot studies with SAs at York University. [4–6,10,17,20,24,25]

Procedures

The researcher presented the study in detail to coaches and administration in January 2023. One week after, the researcher followed up with the coaches via email and asked if they would agree to allow

their teams' participation in the study recruitment. In March 2023, the researcher distributed the study via email to the coaches who agreed to allow their teams participation. In turn, the coaches distributed the study to their SAs by forwarding the email from the researcher. The email consisted of information greeting the SA, introducing the study, the benefits of participating in the study and a link to complete the online questionnaire. The study was held open for SAs to participate for 31 days. The research team sent follow up emails to the coaches to resend information their teams. This occurred 7, 14, 21 and 28 days after the initial emails were sent out. To preserve participant confidentiality, the coaches and outcome assessors were both blinded to the participation of the individual athletes. A third-party researcher who had no association with the varsity sport teams collected and coded all the information from of the questionnaire.

Data Analysis

Data analysis was completed by the research team using IBM SPSS Statistical Software for Windows (IBM SPSS Statistics, Version 24.0; IBM Corp., Armonk, NY, US). Statistical significance was set at $p < 0.05$. Statistical results are presented using frequencies and percentages of the total sample. A univariate frequency distribution was run for all variables to understand the variables and their distribution. The research team decided to combine the participants from field hockey, soccer, and rugby together due to low participation and similarities between sports (playing demands, season length, etc.) into a group referred to as field sports.

All questions using a 5-point Likert scale were re-coded into two groups consisting of never and rarely in one group and almost always and always in the other group. The research team decided to include the middle score of "sometimes" with one group or the other depending on its association with a negative outcome. For example, the question 'do you worry about running out of food due to a lack of money?' would score sometimes with almost always or always because if we are sometimes worrying about running out of food that is not positive. Whereas the question 'do you have consistent access to a

grocery store?' would score sometimes with never or rarely because if we sometimes have access to a grocery store that is not positive.

A two-part bivariate chi-square analysis was conducted to understand differences between various demographic factors (sex, sport, living situation and scholarship) and the health/performance, dietary habits, and nutritional barriers. The results for the bi-variate chi-square analysis were presented as row totals to illustrate which groups reported a specific outcome compared with the other groups instead of showing how much a group reported a specific outcome compared against itself. Finally, a logistic bivariate analysis was completed to understand the odds of athletes having a specific outcome by studying variables including sex, living arrangements, and sport.

CHAPTER 4 - RESULTS

Table 1 summarizes the participant demographic information. In total 75 participants completed the online questionnaire. The sample included 37 male and 38 female SAs from 8 different sports. Ice Hockey was the most represented sport (n=23), and basketball was the least (n=6). Due to low participation and similarity of sport men's and women's soccer, women's field hockey and women's rugby the researcher combined them into one group. Forty percent of the participants were in their first year of study, 22.7% in second, 25.3% in third and 12% in fourth year or higher. 42.7% of the sample lived off campus (on own), 29.3% in residence and 28% at home (with parents). 61.3% of participants worked a job during the past year. 84% of participants reported spending 15 or more hours a week with their team and 26.7% reported spending 20 or more hours a week with their team. In addition, 57.3% of participants reported engaging in high intensity activity 15 hours or more per week. 46.7% of participants did not receive a scholarship of any kind from the University.

Table 1. Participant Information (n=75)

Category	Value n (%)
Sex	
Male	37 (49.3%)
Female	38 (50.7%)
Year of Study	
First	30 (40%)
Second	17 (22.7%)
Third	19 (25.3%)
Fourth or Higher	9 (12%)
Sport	
Volleyball	13 (17.3%)
Basketball	6 (8%)
Football	12 (16%)
Field Sports (Soccer, Field Hockey, Rugby)	13 (17.3%)
Track and Field	8 (10.7%)
Ice Hockey	23 (30.7%)
Living Situation	

Home (Parents)	21 (28%)
Residence	22 (29.3%)
Off Campus (On Own)	32 (42.7%)
Employed during Fall/Winter Semester	
Yes	46 (61.3%)
No	29 (38.7%)
Took a Full Course Load	
Yes	33 (44%)
No	42 (56%)
Team Activity (Practice, Games, Meeting, Lift, etc.) - Hours Per Week	
Less than 15	12 (16%)
15 to 20	43 (57.3%)
20 or More	20 (26.7%)
High Intensity Training (Practice, Game, Lift) - Hours Per Week	
Less than 15	32 (42.7%)
15 or More	43 (57.3%)
Received Scholarship from University (Academic, Athletic, Other)	
Yes	40 (53.3%)
No	35 (46.7%)
Received Additional Funding (OSAP, Grants, Parental, Other)	
Yes	32 (42.7%)
No	43 (57.3%)

Table 1 shows the breakdown of the 75 completed surveys from the 2022-23 fall/winter competitive season. Frequency stands for the total for that given variable and the percentage of that from the total sample.

Table 2 summarizes the second section of the questionnaire focusing on self-reported health symptoms and performance issues. 28% of participants reported being referred to or having sought out a mental health professional over the last year. 46.7% of SAs reported getting sick/ill three or more times over the past Fall/Winter semesters. 46.7%, 62.7%, 50.7% and 61.3% of SAs reported that they sometimes, almost always or always experienced feelings of being over trained, periods of chronic fatigue, lack of endurance during competition and experienced emotional distress states during the past Fall/Winter semesters, respectively.

Table 2. Self-Reported Impact of Symptoms Related to Low Energy Intake (n=75) on Health and Performance

Question	Value n (%)
During the past fall/winter semesters have you been diagnosed with any illness from a medical professional?	
Yes	10 (13.3%)
No	65 (86.7%)
During the past fall/winter semesters have you been prescribed medication/supplementation from a medical professional?	
Yes	12 (16%)
No	63 (84%)
During the past fall/winter semesters have you been referred to or personally sought out a mental health professional?	
Yes	21 (28%)
No	54 (72%)
During the past fall/winter semesters how many times have you gotten an illness or been sick/ill?	
One	15 (20%)
Two	25 (33.3%)
Three	20 (26.7%)
Four or More	15 (20%)
During the past fall/winter semester have you felt that you are able to adapt to your training and recover consistency from demands place on you?	
Almost Always or Always	51 (68%)
Never, Rarely or Sometimes	24 (32%)
During the past fall/winter semester have you felt that you are over trained?	
Sometimes, Almost Always, Always	35 (46.7%)
Never or Rarely	40 (53.3%)
During the past fall/winter semester have you experienced chronic fatigue?	
Sometimes, Almost Always, Always	47 (62.7%)
Never or Rarely	28 (37.3)
During the past fall/winter semester have you experienced a lack of endurance during practice, games, or lifts?	
Sometimes, Almost Always, Always	38 (50.7%)
Never or Rarely	37 (49.3%)
During the past fall/winter semester have you experienced a lack of coordination during practice, games, or lifts?	

Sometimes, Almost Always, Always	13 (17.3%)
Never or Rarely	62 (82.7%)
During the past fall/winter semester have you experienced any emotional distress states (irritability, depression, anxiety, etc.)?	
Sometimes, Almost Always, Always	46 (61.3%)
Never or Rarely	29 (38.7%)

Table 2 reports data from 75 completed surveys from the 2022-23 fall/winter competitive season. Data are expressed as frequency (percentage) where frequency stands for the total number of participant responses for that given variable and percentage of that was calculated from the total sample.

Table 3 summarizes the SAs self-reported nutritional intake habits over the past Fall/Winter semesters. 30.7% of SAs reported never, rarely, or sometimes consuming three meals a day. 44% of SAs reported that they never, rarely, or sometimes consumed breakfast compared to 18.7% and 4% for lunch and dinner, respectively. 96%, 90.7% and 81.3% SAs reported that they almost always or always have protein, carbohydrates, and fats in their meals, respectively. Fruits and vegetables were the least incorporated in meals. 38.7% of SAs reported that they never, rarely, or sometimes included fruits/vegetables in their meals. 72% of SAs reported sometimes, almost always or always feeling hungry when they woke up in the morning and 46.7% reporting sometimes, almost always or always felt hungry when they went to sleep. 54.7% of SAs reported feeling hungry sometimes, almost always or always when they started training. 25.3% and 30.7% of SAs reported never, rarely, or sometimes consuming food within 1 hour before and after their training, respectively. 62.7% of SAs reported almost always or always consuming meals that they cooked from food bought at the store. However, 65.3% reported that they never, rarely, or sometimes prepared meals for themselves ahead of time to bring during the day.

Table 3. Self-Reported Nutritional Intake Habits (n=75)

Question	Value n (%)
I consume three meals a day	
Almost Always or Always	52 (69.3%)
Never, Rarely or Sometimes	23 (30.7%)
I consume breakfast daily	
Almost Always or Always	42 (56%)
Never, Rarely or Sometimes	33 (44%)

I consume lunch daily	
Almost Always or Always	61 (82.3%)
Never, Rarely or Sometimes	14 (18.7%)
I consume dinner daily	
Almost Always or Always	72 (96%)
Never, Rarely or Sometimes	3 (4%)
My meals contain a source of protein	
Almost Always or Always	72 (96%)
Never, Rarely or Sometimes	3 (4%)
My meals contain a source of carbohydrates	
Almost Always or Always	68 (90.7%)
Never, Rarely or Sometimes	7 (9.3%)
My meals contain a source of fats	
Almost Always or Always	61 (81.3%)
Never, Rarely or Sometimes	14 (18.7%)
My meals contain a source of fruits or vegetables	
Almost Always or Always	46 (61.3%)
Never, Rarely or Sometimes	29 (38.7%)
I will consume food withing 1 hour prior to training (practice, game, lift etc.) that I take part in	
Almost Always or Always	56 (74.7%)
Never, Rarely or Sometimes	19 (25.3%)
I will consume food withing 1 hour after my training (practice, game, lift etc.) that I take part in	
Almost Always or Always	52 (69.3%)
Never, Rarely or Sometimes	23 (30.7%)
I am hungry when I start training (practice, game, lift etc.)	
Sometimes, Almost Always, Always	41 (54.7%)
Never or Rarely	34 (45.3%)
I am hungry when I finish training (practice, game, lift etc.)	
Sometimes, Almost Always, Always	72 (96%)
Never or Rarely	3 (4%)
When I wake up in the morning, I am hungry	
Sometimes, Almost Always, Always	54 (72%)
Never or Rarely	21 (28%)

When I go to sleep at night, I am hungry	
Sometimes, Almost Always, Always	35 (46.7%)
Never or Rarely	40 (53.3%)
When I take part in team practices, I have consumed enough food to fuel me for competition	
Almost Always or Always	46 (61.3%)
Never, Rarely or Sometimes	29 (28.7%)
When I compete in a home game, I have consumed enough food to fuel me for competition	
Almost Always or Always	65 (86.7%)
Never, Rarely or Sometimes	10 (13.3%)
When I compete in an away game, I have consumed enough food to fuel me for competition	
Almost Always or Always	52 (69.3%)
Never, Rarely or Sometimes	23 (30.7%)
Normally the meals I consume are cooked by myself with food from the grocery store	
Almost Always or Always	47 (62.7%)
Never, Rarely or Sometimes	28 (37.3%)
Normally the meals I consume are bought from a restaurant either on or off campus	
Almost Always or Always	17 (22.7%)
Never, Rarely or Sometimes	58 (77.3%)
I will prepare meals for myself ahead of time and bring them with me to consume during the day	
Almost Always or Always	26 (34.7%)
Never, Rarely or Sometimes	49 (65.3%)
I will bring snacks with me to consume during the day	
Almost Always or Always	45 (60%)
Never, Rarely or Sometimes	30 (40%)

Table 3 reports data from the 75 completed surveys from the 2022-23 fall/winter competitive season. Data are expressed as frequency (percentage) where frequency stands for the total number of participant responses for that given variable and percentage of that was calculated from the total sample.

Table 4 displays the SAs self-reported impact of different barriers to adequate nutritional intake. This table displays results from five distinct categories: nutritional knowledge, food access/cooking ability, schedule conflicts, monetary impact, and sociocultural impact.

Nutritional Knowledge: 68%, 50.7%, 57.3% of SAs reported that they never, rarely, or sometimes knew how many calories, what types of food and quantities, and what times of the day to eat to best fuel them

based on the demands placed on them, respectively. 70.7% of SAs felt that their team or athletic department never, rarely, or sometimes taught them information about nutrition. Additionally, 58.3% of SAs reported never, rarely, or sometimes applying information about nutrition to their daily routine.

Cooking Ability: 73.3% of SAs reported that they almost always or always feel confident in their technical ability to cook meals for themselves without assistance. 64% of SAs reported that they almost always or always feel confident in their ability to perform complex meal preparation (multiple meals) without assistance.

Food Access: 72% and 78.7% of SAs reported they had consistent access to a full kitchen and to a grocery store, respectively. However, 73.3% of SAs reported that they never, rarely, or sometimes were able to access high quality food on campus. In addition, 96% reported that they never, rarely, or sometimes were able to access high quality food in the athletic center or where they team practices/plays.

Schedule Conflicts: 80%, 76%, 65.3% and 74.7% of SAs reported that their daily schedule sometimes, almost always or always limited their ability to cook and prepare meals, go to the grocery store, forced them to skip meals, or forced them to buy meals, respectively.

Financial Impact: 52% of SAs reported that they sometimes, almost always and always worried about running out of food due to a lack of money. In addition, 37.3% sometimes, almost always or always skipped meals due to a lack of money. Finally, 52% and 52% of SAs reported that they sometimes, almost always or always limited the number of groceries they buy and have compromised the quality of food they eat due to a lack of money, respectively.

Sociocultural Impact: 25.3%, 30.7% and 33.3% of SAs reported that they sometimes, almost always or always restricted their food intake due to a perceived benefit in sport, their perception of their body in sport and the sociocultural perception of an ideal body type for their sport, respectively.

Table 4. Self-Reported Impact of Different Barriers on Nutritional Intake (n = 75)

Category/Question	Value n (%)
NUTRITIONAL KNOWLEDGE	
I know how many calories I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)	
Almost Always or Always	24 (32%)
Never, Rarely or Sometimes	51 (68%)
I know how much protein, carbohydrates, and fats I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)	
Almost Always or Always	53 (70.7%)
Never, Rarely or Sometimes	22 (29.3%)
I know what types of foods and in what quantities I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)	
Almost Always or Always	37 (49.3%)
Never, Rarely or Sometimes	39 (50.7%)
I know what times during the day to eat to best fuel myself based on my sport and academic schedule	
Almost Always or Always	32 (42.7%)
Never, Rarely or Sometimes	43 (57.3%)
I am taught information about nutrition that has helped my knowledge from our athletic department or my team	
Almost Always or Always	22 (29.3%)
Never, Rarely or Sometimes	53 (70.7%)
I apply the information I am taught about nutrition to my daily habits and lifestyle about nutrition	
Almost Always or Always	31 (41.3%)
Never, Rarely or Sometimes	44 (58.7%)
ACCESS/COOKING ABILITY	
I am confident in my technical ability/understanding to cook and prepare meals on my own without assistance	
Almost Always or Always	55 (73.3%)
Never, Rarely or Sometimes	20 (26.7%)
I am confident in my technical ability/understanding to perform more complex meal preparation (multiple meals/days) on my own without assistance	
Almost Always or Always	48 (64%)
Never, Rarely or Sometimes	27 (36%)
I have consistent access to equipment to cook/prepare meals for myself (kitchen, stove, fridge, pans etc.)	

Almost Always or Always	54 (72%)
Never, Rarely or Sometimes	21 (28%)
I have consistent access to a grocery store to buy food for myself	
Almost Always or Always	59 (78.7%)
Never, Rarely or Sometimes	16 (21.3%)
I can access high quality food for myself on campus	
Almost Always or Always	20 (26.7%)
Never, Rarely or Sometimes	55 (73.3%)
I can access high quality food for myself in our athletic center or where my team practices/plays games	
Almost Always or Always	3 (4%)
Never, Rarely or Sometimes	72 (96%)
SCHEDULE CONFLICTS	
My daily schedule commitment (class, sport, commute etc.) limits the time in the day to cook and prepare meals for myself	
Sometimes, Almost Always or Always	60 (80%)
Never or Rarely	15 (20%)
My daily schedule commitment (class, sport, commute etc.) limits the time in the day to go to the grocery store to buy food	
Sometimes, Almost Always or Always	57 (76%)
Never or Rarely	18 (24%)
My daily schedule commitment (class, sport, commute etc.) has forced me to skip meals because I am too busy	
Sometimes, Almost Always or Always	49 (65.3%)
Never or Rarely	26 (34.7%)
My daily schedule commitment (class, sport, commute etc.) has forced me to buy meals on campus because I am too busy	
Sometimes, Almost Always or Always	56 (74.7%)
Never or Rarely	19 (25.3%)
FINANCIAL IMPACT	
I worry about running out of food due to a lack of money	
Sometimes, Almost Always or Always	39 (52%)
Never or Rarely	36 (48%)
I have skipped meals during the day due to a lack of money	
Sometimes, Almost Always or Always	28 (37.3 %)

Never or Rarely	47 (62.7%)
I have limited the number of groceries I buy at the store due to a lack of money	
Sometimes, Almost Always or Always	39 (52%)
Never or Rarely	36 (48%)
I have limited my food intake during the day to a lack of money	
Sometimes, Almost Always or Always	29 (38.7%)
Never or Rarely	46 (61.3%)
I have compromised the quality of the food I am intaking due to a lack of money	
Sometimes, Almost Always or Always	39 (52%)
Never or Rarely	36 (48%)
I have skipped a meal because I cannot afford to buy on campus	
Sometimes, Almost Always or Always	31 (41.3%)
Never or Rarely	44 (58.7%)
SOCIOCULTURAL IMPACT	
I have restricted my daily food intake based on a perceived performance benefit in my sport	
Sometimes, Almost Always or Always	19 (25.3%)
Never or Rarely	56 (74.7%)
I have restricted my daily food intake based on the perception of my body in the sport that I play	
Sometimes, Almost Always or Always	23 (30.7%)
Never or Rarely	52 (69.3%)
I have restricted my daily food intake based on socio-cultural perception of an ideal body type	
Sometimes, Almost Always or Always	25 (33.3%)
Never or Rarely	50 (66.7%)

Table 4 reports data from the 75 completed surveys from the 2022-23 fall/winter competitive season. Data are expressed as frequency (percentage) where frequency stands for the total number of participant responses for that given variable and percentage of that was calculated from the total sample.

Table 5 displays the sex difference comparison of self-reported health symptoms and performance issues. Females were more likely to incur various health and performance impacts compared to males. 71.4% of SAs who were either referred to or sought out a mental health professional were female. Additionally, 63% of SAs who reported that they sometimes, almost always or always experience emotional distress states were females. 80% of SAs who reported getting sick/ill four or more times throughout the year were females. Females accounted for 59.6% of SAs who reported that they

sometimes, almost always or always experienced chronic fatigue. Additionally, females accounted for 76.9% of SAs who reported they sometimes, almost always or always experience lack of coordination during sport or exercise.

Table 5. Comparison of Self-Reported Health Symptoms and Performance Issues by Sex (n =75)

Question/Outcome	Sex n (%)		p value
	MALE (n = 37)	FEMALE (n = 38)	
During the past fall/winter semesters have you been referred to or personally sought out a mental health professional?			
Yes	6 (28.6%)	15 (71.4%)	0.025
No	31 (57.4%)	23 (42.6%)	
During the past fall/winter semesters have you been diagnosed with any illness from a medical professional?			
Yes	2 (20%)	8 (80%)	0.046
No	35 (53.8%)	30 (46.2%)	
During the past fall/winter semesters have you been prescribed medication or supplementation from a medical professional?			
Yes	2 (16.7%)	10 (83.3%)	0.014
No	35 (55.6%)	28 (44.4%)	
During the past fall/winter semesters how many times have you gotten an illness or been sick/ill?			
1	11 (73.3%)	4 (26.7%)	0.034
2	13 (52%)	12 (48%)	
3	10 (50%)	10 (50%)	
4+	3 (20%)	12 (80%)	
During the past fall/winter semester have you experienced chronic fatigue?			
Sometimes, Almost Always or Always	19 (40.4%)	28 (59.6%)	0.046
Never or Rarely	18 (64.3%)	10 (35.7%)	
During the past fall/winter semester have you experienced a lack of coordination during practice, games, or lifts?			
Sometimes, Almost Always or Always	3 (23.1%)	10 (76.9%)	0.037
Never or Rarely	34 (54.8%)	28 (45.2%)	
During the past fall/winter semester have you experienced any emotional distress states (irritability, depression, anxiety etc.)?			
Sometimes, Almost Always or Always	17 (37%)	29 (63%)	0.007

Never or Rarely	20 (69%)	9 (31%)	

Table 5. Data is reported as the total exposure frequency for each category as well as the percentage it represents in the given category (% of the row's total). Results displayed were significant ($p<0.05$)

Table 6 displays the comparison of self-reported impact barriers to nutritional intake by sport. Ten (34%) Football SAs reported that they sometimes, almost always or always limited their food intake due to a lack of money. 10 Volleyball and 10 Football athletes reported that they sometimes, almost always or always compromised their food quality due to a lack of money which represented 25.6% of the row total, respectively. 10 Football SAs reported that they sometimes, almost always or always skipped meals because they could not afford to eat on campus, which represented 32.3% of the row total. Conversely, 18, 14 and 15 Ice Hockey SAs reported never or rarely limiting food intake, compromising food quality, or skipping a meal because they could not afford to eat on campus, which was the largest total of all groups for those categories. No significant differences were found between sports regarding nutritional knowledge, access to food on campus, access to kitchen/equipment or groceries, schedule conflicts or sociocultural influences.

Table 6. Comparison of Self-Reported Barriers to Nutritional Intake by Sport (n=75)

Question/ Outcome	Sport n (%)						
	Volleyball (n = 13)	Basketball (n = 6)	Football (n = 12)	Field Sport (n = 13)	Track and Field (n = 8)	Ice Hockey (n = 23)	p value
I have limited my food intake during the day to a lack of money							
Sometimes, Almost Always or Always	6 (20.7%)	3 (10.3%)	10 (34.5%)	3 (10.3%)	2 (6.9%)	5 (17.2%)	0.009
Never or Rarely	7 (15.2%)	3 (6.5%)	2 (4.3%)	10 (21.7%)	6 (13%)	18 (39.1%)	
I have compromised the quality of the food I am intaking due to a lack of money							
Sometimes, Almost Always or Always	10 (25.6%)	3 (7.7%)	10 (25.6%)	4 (10.3%)	3 (7.7%)	9 (23.1)	0.028
Never or Rarely	3 (8.3%)	3 (8.3%)	2 (5.6%)	9 (25%)	5 (13.9%)	14 (38.9%)	
I have skipped a meal because I cannot afford to buy on campus							
Sometimes, Almost Always or Always	5 (16.1%)	2 (6.5%)	10 (32.3%)	5 (16.1%)	1 (3.2%)	8 (25.8%)	0.033
Never or Rarely	8 (18.2%)	4 (9.1%)	2 (4.5%)	8 (18.2%)	7 (15.9%)	15 (34.1%)	

I can access high quality food for myself on campus							
Almost Always or Always	5 (25%)	4 (20%)	3 (15%)	2 (10%)	2 (10%)	4 (20%)	0.172
Never, Rarely or Sometimes	8 (14.5%)	2 (3.6%)	9 (16.4%)	11 (20%)	6 (10.9%)	19 (34.5%)	
I know how many calories I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)							
Almost Always or Always	2 (8.3%)	3 (12.5%)	4 (16.7%)	5 (20.8%)	3 (12.5%)	7 (29.2%)	0.709
Never, Rarely or Sometimes	11 (21.6%)	3 (5.9%)	8 (15.7%)	8 (15.7%)	5 (9.8%)	16 (31.4%)	
I know how much protein, carbohydrates, and fats I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)							
Almost Always or Always	3 (13.6%)	1 (4.5%)	2 (9.1%)	5 (22.7%)	4 (18.2%)	7 (31.8%)	0.575
Never, Rarely or Sometimes	10 (18.9%)	5 (9.4%)	10 (18.9%)	8 (15.1%	4 (7.5%)	16 (30.2%)	
I have consistent access to equipment to cook/prepare meals for myself (kitchen, stove, fridge, pans etc.)							
Almost Always or Always	9 (16.7%)	5 (9.3%)	8 (9.3%)	10 (18.5%)	4 (7.4%)	18 (33.3%)	0.681
Never, Rarely or Sometimes	4 (19%)	1 (4.8%)	4 (19%)	3 (14.3%)	4 (19%)	5 (23.8%)	
I have consistent access to a grocery store to buy food for myself							
Almost Always or Always	11 (18.6%)	6 (10.2%)	10 (16.9%)	10 (16.9%)	6 (10.2%)	16 (27.1%)	0.657
Never, Rarely or Sometimes	2 (12.5%)	0 (0.0%)	2 (12.5%)	3 (18.8%)	2 (12.5%)	7 (43.8%)	
My daily schedule commitment (class, sport, commute etc.) has forced me to skip meals because I am too busy							
Sometimes, Almost Always or Always	9 (18.4%)	3 (6.1%)	9 (18.4%)	8 (16.3%)	4 (8.2%)	16 (32.7%)	0.806
Never or Rarely	4 (15.4%)	3 (11.5%)	3 (11.5%)	5 (19.2%)	4 (15.4%)	7 (26.9%)	
I have restricted my daily food intake based on socio-cultural perception of an ideal body type							
Sometimes, Almost Always or Always	5 (20%)	0 (0.0%)	3 (12%)	7 (28%)	2 (8%)	8 (32%)	0.282
Never or Rarely	8 (16%)	6 (12%)	9 (18%)	6 (12%)	6 (12%)	15 (30%)	

Table 6 reports data as the total exposure frequency for each category as well as the percentage it represents in the given category (% of the row's total). Significant results are indicated by $p<0.05$.

Table 7 displays comparison of self-reported food access and financial barriers to nutritional intake by living situation. 15 SAs who lived in residence reported that they never, rarely, or sometimes

had access to equipment to cook for themselves which represented 71.4% of the row total. Additionally, 9 SAs who lived in residence reported that they never, rarely, or sometimes had access to a grocery store to buy food which represented 56.3% of the row total. 22 SAs who lived off campus (on own) reported that they sometimes, almost always or always worried about running out of food due to a lack of money which represented 59% of the row total. Additionally, 22 and 19 SAs who lived off campus (on own) reported that they sometimes, almost always or always compromised the quality of their food and skipped a meal because they could not afford to eat on campus. These totals represented 56.4% and 61.3% of their row totals, respectively. Although not significant, those who lived on their own off campus represented 53.8% of SAs who reported they limit how many groceries they buy due to lack of money. 49% of SAs who reported they have skipped meals due to lack of time, lived off campus on their own. 45.5% and 45.8% of SAs who reported they almost always or always knew how many calories and macronutrients they needed to fuel themselves based on their daily demands lived at home with their parents. Finally, no significant differences existed between living situations when asked about access to food on campus or sociocultural influence on their nutritional habits.

Table 7. Comparison of Self-Reported Barriers to Nutritional Intake by Living Situation (n=75)

Question/Outcome	Living Situation n (%)			p value
	Home (Parents) (n = 21)	Residence (n = 22)	Off Campus (On Own) (n = 32)	
I have consistent access to equipment to cook/prepare meals for myself (kitchen, stove, fridge, pans etc.)				
Almost Always or Always	17 (31.5%)	7 (13%)	30 (55.6%)	< 0.001
Never, Rarely or Sometimes	4 (19%)	15 (71.4%)	2 (9.5%)	
I have consistent access to a grocery store to buy food for myself				
Almost Always or Always	19 (32.2%)	13 (22%)	27 (45.8%)	0.025
Never, Rarely or Sometimes	2 (12.5%)	9 (56.3%)	5 (31.3%)	
I worry about running out of food due to a lack of money				
Sometimes, Almost Always or Always	6 (15.4%)	10 (25.6%)	23 (59%)	0.007
Never or Rarely	15 (41.7%)	12 (33.3%)	9 (25%)	
I have compromised the quality of the food I am intaking due to a lack of money				

Sometimes, Almost Always or Always	8 (20.5%)	9 (23.2%)	22 (56.4%)	0.043
Never or Rarely	13 (36.1%)	13 (36.1%)	10 (27.8%)	
I have skipped a meal because I cannot afford to buy on campus				
Sometimes, Almost Always or Always	8 (25.8%)	4 (12.9%)	19 (61.3%)	0.01
Never or Rarely	13 (29.5%)	18 (40.9%)	13 (29.5%)	
I have limited the number of groceries I buy at the store due to a lack of money				
Sometimes, Almost Always or Always	7 (17.9%)	11 (28.2%)	21 (53.8%)	0.069
Never or Rarely	14 (38.9%)	11 (30.6%)	11 (30.6%)	
My daily schedule commitment (class, sport, commute etc.) has forced me to skip meals because I am too busy				
Sometimes, Almost Always or Always	14 (28.6%)	11 (22.4%)	24 (49%)	0.164
Never or Rarely	7 (26.9%)	11 (42.3%)	8 (30.4%)	
I can access high quality food for myself on campus				
Almost Always or Always	4 (20%)	7 (35%)	9 (45%)	0.620
Never, Rarely or Sometimes	17 (30.9%)	15 (27.3%)	23 (42.8%)	
I know how many calories I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)				
Almost Always or Always	11 (45.8%)	6 (25.0%)	7 (29.2%)	0.057
Never, Rarely or Sometimes	10 (29.6%)	16 (31.4%)	25 (49.0%)	
I know how much protein, carbohydrates, and fats I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)				
Almost Always or Always	10 (45.5%)	6 (27.3%)	6 (27.3%)	0.076
Never, Rarely or Sometimes	11 (20.8%)	16 (30.2%)	26 (49.1%)	
I have restricted my daily food intake based on socio-cultural perception of an ideal body type				
Sometimes, Almost Always or Always	6 (24.0%)	9 (36.0%)	10 (40.0%)	0.655
Never or Rarely	15 (30.0%)	13 (26.0%)	22 (44.0%)	

Table 7. Data is reported as the total exposure frequency for each category as well as the percentage it represents in the given category (% of the row's total). Significant results are indicated by $p<0.05$.

Table 8 displays the comparison of self-reported monetary impact barriers by scholarship status. 18 SAs who did not receive a scholarship from the university reported that they sometimes, almost always or always skipped meals due to a lack of money which represents 64.3% of the row total. Further, 23 and 19 SAs who did receive a scholarship from the university reported that they sometimes, almost always or always have limited the groceries they buy at the store and skipped a meal because they cannot afford to

eat on campus. These represented 65.7% and 61.3% of their row totals, respectively. No significant differences were found between sports regarding nutritional knowledge, access to food on campus, access to kitchen/equipment or groceries, schedule conflicts or sociocultural influences.

Table 8. Comparison of Self-Reported Barriers to Nutritional Intake by Scholarship Status (n=75)

Outcome/Question	Received Scholarship (Academic, Athletic, Other)		p value
	Yes (n = 40)	No (n = 35)	
I have skipped meals during the day due to a lack of money			
Sometimes, Almost Always or Always	10 (35.7%)	18 (64.3%)	0.018
Never or Rarely	30 (63.8%)	17 (36.2%)	
I have limited the number of groceries I buy at the store due to a lack of money			
Sometimes, Almost Always or Always	16 (41%)	23 (65.7%)	0.026
Never or Rarely	24 (66.7%)	12 (33.3%)	
I have skipped a meal because I cannot afford to buy on campus			
Sometimes, Almost Always or Always	12 (38.7%)	19 (61.3%)	0.033
Never or Rarely	28 (63.6%)	16 (36.4%)	
I can access high quality food for myself on campus			
Almost Always or Always	8 (40.0%)	12 (60.0%)	0.485
Never, Rarely or Sometimes	27 (49.1%)	28 (50.9%)	
I know how many calories I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)			
Almost Always or Always	11 (45.8%)	13 (54.2%)	0.921
Never, Rarely or Sometimes	24 (47.1%)	27 (52.9%)	
I know how much protein, carbohydrates, and fats I need to intake during a day to fuel me for the demands placed upon me (Practice, Games, Lifts etc.)			
Almost Always or Always	12 (54.5%)	10 (45.5%)	0.378
Never, Rarely or Sometimes	23 (43.4%)	30 (56.6%)	
I have consistent access to equipment to cook/prepare meals for myself (kitchen, stove, fridge, pans etc.)			
Almost Always or Always	23 (42.6%)	31 (57.4%)	0.257
Never, Rarely or Sometimes	12 (57.1%)	9 (42.9%)	
I have consistent access to a grocery store to buy food for myself			
Almost Always or Always	28 (47.5%)	31 (52.5%)	0.792
Never, Rarely or Sometimes	7 (43.8%)	9 (56.3%)	

My daily schedule commitment (class, sport, commute etc.) has forced me to skip meals because I am too busy			
Sometimes, Almost Always or Always	24 (49.0%)	25 (51%)	0.582
Never or Rarely	11 (42.3%)	15 (57.7%)	
I have restricted my daily food intake based on socio-cultural perception of an ideal body type			
Sometimes, Almost Always or Always	10 (40.0%)	15 (60.0%)	0.413
Never or Rarely	25 (50.0%)	25 (50.0%)	

Table 8. Data is reported as the total exposure frequency for each category as well as the percentage it represents in the given category (% of the row's total). Significant results are indicated by $p<0.05$.

Table 9 displays the association between sport and various monetary impact barriers to nutritional intake. Ice Hockey SAs were chosen as the comparison group due to them being the largest group within the sample and from information in Table 6 showing they were most likely to never or rarely have issues accessing nutrition due to a lack of money. Football SAs were 18 times more likely to report that they sometimes, almost always or always limited their food intake due to a lack of money compared with Ice Hockey SAs (OR = 18.00, 95% CI [2.94, 110.31]). Football SAs were 7.78 times more like than Ice Hockey SAs to report that they sometimes, almost always or always compromised the quality of their food due to a lack of money (OR = 7.78, 95% CI [1.38, 44.04]). Additionally, Volleyball SAs were 5.19 times more likely that Ice Hockey SAs to report sometimes, almost always or always compromised the quality of their food due to a lack of money (OR = 5.19, 95% CI, [1.11, 24.14]). Finally, Football SAs were 9.38 times more likely than Ice Hockey SAs to report that they sometimes, almost always or always skipped a meal because they could not afford to eat on campus (OR = 9.38, 95% CI, [1.64, 53.62]).

Table 9. Logistic regression of the association between Sport and Financial Barriers to Nutritional Intake among varsity SAs (n=75)

Question/Team	OR (95% CI)
I have limited my food intake during the day due to a lack of money	
Ice Hockey	1
Volleyball	3.09 (0.71, 13.46)
Basketball	3.60 (0.55, 23.65)
Football	18.00 (2.94, 110.31)
Field Sports	1.08 (0.21, 5.49)

Track and Field	1.20 (0.18, 7.88)
I have compromised the quality of the food I am eating due to a lack of money	
Ice Hockey	1
Volleyball	5.19 (1.11, 24.14)
Basketball	1.56 (0.26, 9.47)
Football	7.778 (1.38, 44.04)
Field Sports	0.69 (0.16, 2.93)
Track and Field	0.93 (0.18, 4.90)
I have skipped a meal because I cannot afford to buy food on campus	
Ice Hockey	1
Volleyball	1.17 (0.29, 4.79)
Basketball	0.94 (0.14, 6.28)
Football	9.38 (1.64, 53.62)
Field Sports	1.17 (0.29, 4.79)
Track and Field	0.27 (0.02, 2.58)

Table 9 reports data using the exponentiated beta (Exp B) which represents the odds ratio. Confidence intervals (95% CI) are reported as the lower and upper limits. Significance level $p<0.05$.

Table 10 displays the association between living situation and various access/monetary impact barriers to nutritional intake. SAs who lived at home (parents) were chosen as the comparison group based on information from table 7 showing they were the least likely to experience financial barriers when accessing nutrition. SAs who lived off campus (on own) were 3.58 times more likely than those who lived at home (with parents) to report they sometimes, almost always or always compromised the quality of they food they intake due to a lack of money (OR = 3.58, 95% CI, [1.13, 11.35]). Additionally, SAs who lived off campus (own own) were 6.39 times more likely to report they sometimes, almost always or always worried about running out of food due to a lack of money and 3.82 times more likely to have limited the amount of groceries they buy due to a lack of money when compare with SAs who lived at home (parents) (OR = 6.39, 95% CI, [1.89, 21.66], OR = 3.82, 95% CI, [1.19, 12.23]). SAs who lived in residence were 10.29 times more likely than SAs who lived at home (parents) to report they never, rarely, or sometimes prepared meals for themselves ahead of time to bring with them during the day (OR = 10.29, 95% CI, [2.29, 46.25]). SAs who lived off campus (on own) were 3.58 times more likely than

those who lived at home (with parents) to report they never, rarely, or sometimes prepared meals for themselves ahead of time to bring with them during the day (OR = 3.58, 95% CI, [1.13, 11.35]). SAs who lived in residence were 9.11 times more likely than those who lived at home (with parents) to report they never, rarely, or sometimes had consistent access to equipment to cook/prepare meals for themselves (OR = 9.11, 95% CI, [2.22, 37.34]). SAs who lived in residences were 6.58 times more likely compared with SAs who live at home (with parents) to report that they never, rarely, or sometimes had consistent access to a grocery store to buy food for themselves (OR = 6.58, 95% CI, [1.22, 35.53]).

Table 10. Logistic regression of the association between Living Situation and Access/Financial Barriers to Nutritional Intake among varsity SAs (n=75).

Question/Living Situation	OR (95% CI)
I have compromised the quality of the food I am eating due to a lack of money	
Home (Parents)	1
Residence	1.13 (0.33, 3.83)
Off Campus (On Own)	3.58 (1.13, 11.35)
I worry about running out of food due to a lack of money	
Home (Parents)	1
Residence	2.08 (0.59, 7.38)
Off Campus (On Own)	6.39 (1.89, 21.66)
I have limited the amount of groceries I buy at the store due to a lack of money	
Home (Parents)	1
Residence	2.00 (0.58, 6.87)
Off Campus (On Own)	3.82 (1.19, 12.23)
I will prepare meals for myself ahead of time and bring them with me to consume during the day	
Home (Parents)	1
Residence	10.29 (2.29, 46.25)
Off Campus (On Own)	3.58 (1.13, 11.35)
I have consistent access to equipment to cook/prepare meals for myself (kitchen, stove, fridge, pans etc.)	
Home (Parents)	1
Residence	9.11 (2.22, 37.34)
Off Campus (On Own)	0.28 (0.05, 1.71)
I have consistent access to a grocery store to buy food for myself	
Home (Parents)	1

Residence	6.58 (1.22, 35.53)
Off Campus (On Own)	1.76 (0.31, 10.04)

Table 10 reports data using the exponentiated beta (Exp B) which stands for the odds ratio. Confidence intervals (95% CI) are reported as the lower and upper limits. Significance level $p<0.05$.

CHAPTER 5 - DISCUSSION

This study examined dietary habits and attempted to identify barriers that impacted SAs nutritional intake at York University. Results showed that this sample of SAs are not achieving three meals a day and almost half of the SAs reported that they experience periods of hunger during training and throughout the day. Prevalent barriers to nutritional intake reported in this sample of SAs consisted of lack of nutritional knowledge, lack of access to healthy food on campus, schedule conflicts and monetary impact. In this sample, 68% SAs reported that they never, rarely, or sometimes knew the quantity of calories they needed to best fuel themselves based on the demands placed on them. Additionally, 73% of SAs reported that they never, rarely, or sometimes were able to access high quality food on campus. Almost 80% of SAs reported that their daily schedule sometimes, almost always or always limited their ability to cook and prepare meals. 52% of SAs reported that they sometimes and always worried about running out of food due to a lack of money. Football SAs were 18 times more likely to report that they sometimes, almost always or always limited their food intake due to a lack of money compared with Ice Hockey SAs (OR = 18.00, 95% CI [2.94, 110.31]). SAs who lived off campus (on own) were 3.58 times more likely than those who lived at home (with parents) to report they sometimes, almost always or always compromised the quality of the food they intake due to a lack of money (OR = 3.58, 95% CI, [1.13, 11.35]). Female SAs were more likely to self-report experiencing health/performance decrements associated with under-fueling compared with male SAs. Females accounted for 80% of SAs who reported getting sick/ill four or more times throughout the year. Females accounted for 60% of SAs who reported that they sometimes, almost always or always experienced chronic fatigue.

Due to the demands placed on them, athletes involved in higher levels of sport will have increased nutritional requirements from non-athletes.[3,26] Although nutrition was not directly assessed, in this sample, 30% of SAs reported that they never, rarely, or sometimes eat three meals a day and 44% never, rarely, or sometimes eat breakfast. Thus, it is possible that by omitting meals, they may not be meeting their daily energy (and nutrient) needs. SAs within this study reported periods of hungry with

46.7% of SAs reported sometimes, almost always or always feeling hungry when they went to sleep and 54.7% were hungry when they started training. Food insecurity has been reported in Canadian University students (non-athletes).[7–9] Research performed in American NCAA div3 SAs showed 30% of SAs experienced some form of food insecurity (not having access to sufficient food, or food of adequate quality, to meet one's basic needs) and hunger during their competitive year.[15] In a separate study evaluating NCAA div 3 SAs, 14.7% of SAs experienced periods of food insecurity during their competitive year. [14] To our knowledge, this is the first study to demonstrate that Canadian varsity-level SAs are dealing with barriers to nutritional intake, and that these are like US athletes.

SAs included in this study commonly reported that they never, rarely, or sometimes knew how many calories or macronutrients (protein, carbohydrates, fats) to consume, what types of food to consume or what times of the day to consume food to match the demands placed on them. Although it may seem that a lack of nutritional knowledge may act as a barrier regarding nutrition, a systematic review performed on nutritional knowledge found a range from no correlation to weak correlations for the impact of nutritional knowledge on intake in nine studies.[19] This is likely due to other factors (i.e., money and time) predominating over the importance of nutrition knowledge in affecting food intake. Indeed, in a study performed on USPORT female hockey players (n=26) nutritional knowledge of SAs with poor diet quality was no different from those with better diet quality.[24] Therefore, it is important to acknowledge that although the majority of SAs within this study reported issues with nutritional knowledge, this barrier may not be as impactful of a barrier on nutritional intake as other factors.

Research has shown that limited access to healthy foods or easy access to unhealthy foods is a perceived barrier for national team athletes, SAs in NCAA and non-SAs in Canadian universities. [6,17,20] SAs included in this study commonly reported that they struggle to access high quality nutrition on campus or the athletic center. SAs who lived in residence were less likely to have access to a grocery store/kitchen to prepare meals and were more likely to rely on buying meals from campus than those who live off campus or at home. SAs who did not live in residence reported they had consistent access to a

grocery store, access to a kitchen and felt confident in their ability to prepare meals for themselves. However, the majority of SAs included in this study listed that a lack of time due to their daily schedule limited their ability to go to the grocery store and cook meals for themselves. Therefore, it seems that a lack of access to high quality food on campus paired with a demanding schedule creates a powerful barrier to accessing nutrition for SAs.

Financial impact was a common barrier that impacted SAs ability to consistently access nutrition. However, financial impact on nutritional intake was not the same for all SAs in this study. SAs who played football, lived off campus (on their own) or did not receive a scholar from the university were more likely to worry about running out of food due to a lack of money. SAs who live off campus or in residence have differences in the cost of living compared to those who live at home with their parents. Additionally, collegiate SAs can come from a wide variety of socio-economic backgrounds and financial support levels. In a study perform on NCAA div3 SAs (n=787) specific groups such as those from racialized backgrounds or recipients of government financial aid were more likely to experience food insecurity than their counterparts.[15] Football SAs in particular may be under more direction and pressure to gain or maintain higher bodyweights depending on position and in turn will require more nutritional intake to achieve this. Although all SAs are under the same expectations from an athletic and academic lens, there are major differences in their ability to financially support themselves. This becomes very prevalent when accessing nutrition and the ability to consistently afford food for themselves.

From the SAs included in this study, females accounted for almost 80% of SAs who reported getting sick/ill four or more times throughout the year. Females accounted for 60% and 77% of SAs who reported that they sometimes, almost always or always experienced chronic fatigue or lack of coordination. It is important to highlight that this study did not measure energy intake and expenditure and therefore cannot determine if these health and performance related issues are related directly to inadequate nutritional intake and LEA. Nonetheless, a study performed on female athletes (n=1000) showed athletes who were considered to have LEA were more likely to experience impaired judgment,

decreased training response, decreased concentration, and depression than those with adequate energy intake.[12] Therefore, it is possible that female SAs included in this study were not achieving adequate energy intake based on their reported health/performance issues.

The results of this study can be used by York University Athletics and other USPORT athletic departments to better understand the factors that affect SAs nutritional intake. Based on the information from this study the following protocols are suggested to help the situation. First, improving the availability of high quality, cost-friendly nutrition options on campus and specifically in the athletic center is a necessity to help this problem. Given the high demands on their time and their busy schedules, SAs need to have some accessible, grab-and-go energy (and nutrient) dense food solutions for refueling. Second, improving funding for SAs who live on their own, do not have scholarship funding or are found to be from a low socio-economic background. This could involve the creation of discounted food options on campus and in the athletic facilities for SAs who are not on scholarship or for those that live on their own. Last, these interventions could be supported further by using applied nutrition education programs that give SAs information on how to find practical solutions to combat these barriers (i.e. How to grocery shop on a budget). However, the latter should be implemented concomitantly with strategies to alleviate time, financial and food access issues for it to be most successful as an intervention.

The primary strength of this study is that it is a novel study that evaluated the barriers faced by Canadian collegiate SAs (across multiple sports) to nutritional intake and the potential impacts that these barriers have on health, performance and other life factors. The weakness is that it had an overall small sample size compared to the total number of SAs at the University. The odds ratios and confidence intervals reported may not be accurate due to issues with the small sample size potentially influencing the logistic regression. Sport teams were not represented equally by sex, and this may have acted as a confounding variable in the logistic regression, however samples were too small to stratify by sex. Future research should look to perform this same study within another university athletics department to see if there are similarities or differences based on school resource differences and demographics (i.e., Toronto

vs other cities). Next, research could look to determine the differences between what USPORT SAs are eating relative to their activity levels to determine their energy availability. This could be performed by collecting dietary recalls throughout the fall/winter semesters and using technology to monitor the daily energy outputs of SAs. Furthermore, research looking at tracking the SAs body composition or measuring blood biomarkers of food intake or health status throughout a season/year could help determine any health deterioration occurring due to lack of nutrition.

CHAPTER 6 - CONCLUSION

SAs included in this study did not consistently consume three meals a day. They experienced difficulties with their nutritional intake due to a wide variety of barriers. Lack of time, financial issues, and limited access to food on campus were prevalent barriers that affected nutritional intake. These barriers are complicated problems that can act in tandem with each other to impact some SAs more than others. SAs who lived on their own and/or played football experienced significant financially related barriers when accessing nutrition. Female SAs reported higher levels of health/performance related issues that can stem from LEA compared to their male counterparts. Interventions to mitigate these barriers could involve improving food availability on campus, increasing financial aid for identified groups of SAs and supporting the creation of applied nutrition education programs.

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APPENDIX A: Informed Consent Form

Study Name: Dietary Habits and Barriers to Nutrition for USPORTS varsity athletes.

Researcher name: My name is Emerson Morassutti, and I am the principal investigator for this research. I am a student in the Master of Science, Kinesiology and Health Science degree.

Purpose of the Research:

- The purpose of this research is 1) to understand the dietary practices of student athletes at York University, 2) to understand what barriers student athletes face regarding nutritional intake and 3) identify if any student athletes have experienced health/performance related issues that relate to nutritional intake.
- The information will be presented in a research paper and presentations to staff and administration.
- Data from this study will be used in the researcher's master's thesis.
- The information gathered from this research will be used for written papers and presentations. Identifying information of individual participants will not be used at any point during presentation of data. However, data may be displayed by sport and sex. This study will follow current practices and guidelines for use of data. If any sample has less than 5 participants, it will not be presented as a subgroup for analysis and be included in more general populations.

What You Will Be Asked to Do in the Research:

- As a research participant you will be asked to participate in an online questionnaire.
- The online questionnaire will ask you about general characteristics, general health and performance questions, dietary habits, and perceived impact of different nutritional barriers.
- The online questionnaire will take participants 15-20 minutes of time to complete.

Risks and Discomforts:

This study will ask you to answer questions regarding knowledge and understanding of nutrition, financial security, and disordered eating history. If any of these questions elicit feelings of emotional/mental discomfort, please access the following links below for assistance:

- **York University Student Counseling, Health, and Well-being**
    - https://counselling.students.yorku.ca/
- **York Federation of Students Food Support Center**
    - http://www.yfs.ca/fsc

Benefits of the Research and Benefits to You:

- This study is the first of its kind to occur not only at York University but also the OUA and USPORTS.
- The information collected will help inform our administration and other institutions about the dietary realities of student athletes in Canada.
- This information could help create initiatives and programs that would directly benefit you and your experience as a student athlete. In addition, it will benefit future generations of York Lions and student athletes across the country.

Voluntary Participation and Withdrawal:

Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer, to stop participating, or to refuse to answer questions will not influence the treatment you may be receiving, nature of the ongoing relationship you may have with the researchers or study staff and the nature of your relationship with York University either now, or in the future. In the event you withdraw from the study, all associated data collected will be immediately destroyed wherever possible. Should you wish to withdraw after the study, you will have the option to also withdraw your data up until the analysis is complete.

Confidentiality

All information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research.

Information will be collected electronically through websites and stored using a data software called RedCap. This program is used by many researchers at York University to store personal data safely and securely. Your data will be safely stored in a secure online database and only research staff/research

team members will have access to this information. The information collected from this study will be kept for no longer than 5 years from the completion of the study. Upon completion of this period all data from this study will be destroyed no later than April 1, 2028. Confidentiality will be fully provided possible by law.

The researcher(s) acknowledge that the host of the online survey may automatically collect participant data without their knowledge. Although this information may be provided or made accessible to the researchers, it will not be used or saved without participant's consent on the researcher's system. Further, Because this project employs e-based collection techniques, data may be subject to access by third parties because of various security legislation now in place in many countries and thus the confidentiality and privacy of data cannot be guaranteed during web-based transmission.

Questions About the Research?

If you have questions about the research in general or about your role in the study, please feel free to contact me at emoras@yorku.ca or my supervisor, Alison Macpherson at alison3@yorku.ca and/or 416 736 2100 Ext. 77216.

This research has received ethics review and approval by the Delegated Ethics Review Committee, which is delegated authority to review research ethics protocols by the Human Participants Review Sub-Committee, York University's Ethics Review Board, and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Director, Research Ethics in the Office of Research Ethics, 5th Floor, Kaneff Tower, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Signatures:

I_____, consent to participate in 'The relationship between dietary intake and barriers to nutrition for USPORTS varsity athletes' conducted by Emerson Morassutti. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

APPENDIX B: Questionnaire

Demographics

1. What is your age?
2. What is your year of study?
3. What is your program of study?
4. What sport do you play?
    - Volleyball, Basketball, Football (American), Soccer, Track and Field, Rugby, Field Hockey, Ice Hockey, Other
5. What is your sex?
6. What is your ethnicity?
    - Caucasian, African American, Asian, South-east Asian, Hispanic, Middle eastern, Indigenous, Pacific Islander, Other
7. Do you have any religious association?
    - Yes, No
    - If yes, what religion do you associate with?
8. Where is your place of residence?
    - Home (Parents), Residence, Off Campus (On Own)
9. During the fall/winter semester do you work a job?
    - Yes/No
    - If yes, how many hours per week?
10. During the fall/winter semester are you enrolled in a full course load? (5 classes)
    - Yes/No
    - If no, how many classes are you currently enrolled in?
11. During the fall/winter semester how many hours a week are you involved with team-based activities (practice, workout, game, film, meetings etc.)?

- Less than 5, 5 to 10 hours, 15 to 20 hours, more than 20 hours

12. During the fall/winter semester how many hours a week are you involved with high intensity exercise (practice, workout, game)?
    - Less than 5, 5 to 10 hours, 15 to 20 hours, more than 20 hours
13. Do you currently receive a scholarship from the university?
    - Yes/No
14. Do you currently receive any additional funding?
    - OSAP, Bank Loan, Other, No

Health/Performance

1. During the past fall/winter semesters has a medical professional diagnosed you with any illness?
    - Yes/No
    - If yes, please provided further details.
2. During the past fall/winter semesters has a medical professional prescribed you medication/supplementation for any illness?
    - Yes/No
    - If yes, please list the medication/supplementation.
3. During the past fall/winter semesters has a medical professional referred you or you personally sought out a mental health professional?
    - Yes/No
    - If yes, what was the main reason for going?
4. In the past year, has your menstruation cycle been regular and consistent? (Females Only)
    - Yes/No
    - If no, how many cycles have you missed?
5. Do you take any form of contraception? (Females Only)
    - Yes/No

6. During the past fall/winter semesters has a medical professional diagnosed you with a bone stress injury of any kind?
    - Yes/No
    - If yes, how many and where?
7. During the past fall/winter semesters how many times have you gotten an illness or been sick?
    - 1, 2, 3, 4, more
8. During the past fall/winter semesters how many different injuries have you sustained through sport in which you had to miss time from sport?
    - 1, 2, 3, 4, more
9. During the past fall/winter semesters have you felt that you are able to adapt to your training and recover consistently from the demand placed on you?
    - Never, Rarely, Sometimes, Almost Always, Always
10. During the past fall/winter semesters have you felt that you are overtrained?
    - Never, Rarely, Sometimes, Almost Always, Always
11. During the past fall/winter semesters have you experienced periods of chronic fatigue?
    - Never, Rarely, Sometimes, Almost Always, Always
12. During the past fall/winter semesters have you experienced a lack of endurance during practices, games, or lifts?
    - Never, Rarely, Sometimes, Almost Always, Always
13. During the past fall/winter semesters have you experienced a lack of coordination during practice, games, or lifts?
    - Never, Rarely, Sometimes, Almost Always, Always
14. During the past fall/winter semesters have you felt that you are able to adapt to your training and recover consistently from the demand placed on you?
    - Never, Rarely, Sometimes, Almost Always, Always

15. During the past fall/winter semesters have you experienced any emotional distress states? (irritability, depression, anxiety etc.)
    - Never, Rarely, Sometimes, Almost Always, Always

Dietary Habits

1. I consume 3 meals a day.
    - Never, Rarely, Sometime, Almost Always, Always
2. I consume breakfast daily.
    - Never, Rarely, Sometime, Almost Always, Always
3. I consume lunch daily.
    - Never, Rarely, Sometime, Almost Always, Always
4. I consume dinner daily.
    - Never, Rarely, Sometime, Almost Always, Always
5. My meals contain a source of protein.
    - Never, Rarely, Sometime, Almost Always, Always
6. My meals contain a source of carbohydrates.
    - Never, Rarely, Sometime, Almost Always, Always
7. My meals contain a source of fats.
    - Never, Rarely, Sometime, Almost Always, Always
8. My meals contain a source of fruits/vegetables.
    - Never, Rarely, Sometime, Almost Always, Always
9. My meals contain a source of supplementation (vitamins, protein powder etc.)
    - Never, Rarely, Sometime, Almost Always, Always
10. I consume enough food to fuel me during the day based on my daily schedule (practice, game, lift, class, work etc.)
    - Never, Rarely, Sometime, Almost Always, Always

11. I consume food within 1 hour prior to training (practice, game, lift) that I partake in with my team.
    - Never, Rarely, Sometime, Almost Always, Always
12. I consume food within 1 hour after training (practice, game, lift) that I partake in with my team.
    - Never, Rarely, Sometime, Almost Always, Always
13. I am hungry when I start training (Practice, Game, Lift etc.) with my team.
    - Never, Rarely, Sometime, Almost Always, Always
14. I am hungry when I finish training (Practice, Game, Lift etc.) with my team.
    - Never, Rarely, Sometime, Almost Always, Always
15. When I wake up in the morning, I am hungry.
    - Never, Rarely, Sometime, Almost Always, Always
16. When I go to sleep at night, I am hungry.
    - Never, Rarely, Sometime, Almost Always, Always
17. When we practice, I have consumed enough food to fuel me for competition.
    - Never, Rarely, Sometime, Almost Always, Always
18. When we play a home game, I have consumed enough food to fuel me for competition.
    - Never, Rarely, Sometime, Almost Always, Always
19. When we play an away game, I have consumed enough food to fuel me for competition.
    - Never, Rarely, Sometime, Almost Always, Always
20. When we play a home game, I have consumed enough food to fuel me for competition.
    - Never, Rarely, Sometime, Almost Always, Always
21. When we play a home game, the team provides me with enough food to fuel me for competition.
    - Never, Rarely, Sometime, Almost Always, Always
22. When we play an away game, the team provides me with enough food to fuel me for competition.
    - Never, Rarely, Sometime, Almost Always, Always
23. Normally I eat meals that I cook are with food from the grocery store.

- Never, Rarely, Sometime, Almost Always, Always

24. Normally I eat meals that I purchased from a restaurant on or off campus.
    - Never, Rarely, Sometime, Almost Always, Always
25. I will prepare meals for myself ahead of time and bring them with me to consume throughout the day.
    - Never, Rarely, Sometime, Almost Always, Always
26. I will bring small snack with me to consume during the day.
    - Never, Rarely, Sometime, Almost Always, Always

Barriers to Nutrition

Knowledge and Application

1. I know how many calories I need to intake during a day to fuel myself for the demands placed upon me (Sport, Practice, Games, Lift, etc.)?
    - Never, Rarely, Sometime, Almost Always, Always
2. I know how much protein, carbohydrates, and fats I need to intake during a day to fuel myself for the demands placed upon me (Sport, Practice, Games, Lift, etc.)?
    - Never, Rarely, Sometime, Almost Always, Always
3. I know what types of food and in what quantities that can best provide the nutrients needed to fuel myself.
    - Never, Rarely, Sometime, Almost Always, Always
4. I know what times during the day to eat to best fuel myself based on my sport and academic schedules.
    - Never, Rarely, Sometime, Almost Always, Always
5. I am taught information about nutrition that has benefitted my knowledge from our athletic department or my team.
    - Never, Rarely, Sometime, Almost Always, Always

6. I apply the information that my teams or athletic department teaches me about nutrition to my daily habits and lifestyle regarding nutrition.
    - Never, Rarely, Sometime, Almost Always, Always
7. I am confident in my technical ability/understanding to cook and prepare meals on my own without assistance.
    - Never, Rarely, Sometime, Almost Always, Always
8. I am confident in my technical ability/understanding to perform more complex meal preparation (multiple meals/days) on my own without assistance.
    - Never, Rarely, Sometime, Almost Always, Always

Access

1. I have consistent access to equipment to cook/prepare meals for myself (kitchen, stove, fridge, pans, etc.)
    - Never, Rarely, Sometime, Almost Always, Always
2. I can access grocery store to buy food for myself.
    - Never, Rarely, Sometime, Almost Always, Always
3. I can access high quality food for myself on campus.
    - Never, Rarely, Sometime, Almost Always, Always
4. I can access high quality food in Tait McKenzie (Athletic Complex) or where my team practices/plays games.
    - Never, Rarely, Sometime, Almost Always, Always

Schedule Conflicts

1. My daily schedule commitment (class, sport, commute etc.) limits the time in the day to cook and prepare meals for myself.
    - Never, Rarely, Sometime, Almost Always, Always

2. My daily schedule commitment (class, sport, commute etc.) limits the time in the day to go to the grocery store to buy food.
    - Never, Rarely, Sometime, Almost Always, Always
3. My daily schedule commitment (class, sport, commute etc.) has forced me to skip meals because I am too busy.
    - Never, Rarely, Sometime, Almost Always, Always
4. My daily schedule commitment (class, sport, commute etc.) has forced me to buy meals on campus because I am too busy to cook/prepare meals.
    - Never, Rarely, Sometime, Almost Always, Always

Financial Limitations

1. I worry about running out of food due to a lack on money.
    - Never, Rarely, Sometime, Almost Always, Always
2. I have limited the number of groceries I buy at the store due to a lack of money.
    - Never, Rarely, Sometime, Almost Always, Always
3. I have limited my food intake during the day due to a lack of money.
    - Never, Rarely, Sometime, Almost Always, Always
4. I have compromised the quality of food I am intaking due to a lack of money.
    - Never, Rarely, Sometime, Almost Always, Always
5. I have skipped meals because I cannot afford to buy food on campus.
    - Never, Rarely, Sometime, Almost Always, Always

Social and Sport Influences

1. I have restricted my food intake based on the perception of my body appearance in the sport that I play.
    - Never, Rarely, Sometime, Almost Always, Always
2. I have restricted my food intake based on a perceived performance benefit in my sport.

- Never, Rarely, Sometime, Almost Always, Always

3. I have restricted my food intake based on the socio-cultural perception of an ideal body type.
    - Never, Rarely, Sometime, Almost Always, Always