

Review

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Review

# Prevalence of and Contributors to Food Insecurity among College Athletes: A Scoping Review

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**Abstract:** Given the financial demands of attending college, the transition to new living situations, abrupt changes in social support, and overall lifestyle adjustments, college students are at an increased risk of food insecurity (FI) compared to the general population. Collegiate athletes experience an even greater risk of FI as a result of greater time commitments and energy demands associated with their sports. This heightened vulnerability poses a tremendous threat to student-athletes' academic and athletic achievements. This study aims to address the prevalence and primary determinants of FI among collegiate athletes while providing potential solutions to navigate and alleviate the effects of diminished food security among this demographic. To address these aims, a total of 18 articles were selected from both peer-reviewed and gray literature. The U.S. Household Food Security Survey Module (US-HFSSM) survey tools were predominantly utilized across universities throughout the United States to gather data on FI. Student-athletes reported experiencing FI across various regions of the United States, including universities in northeastern states (n=5), the southwest region (n=3), the southeast region (n=3), the northwest (n=1), and the Midwest (n=1). Overall, FI prevalence rates ranged from 9.9% to 65% and the most significant contributors included limited financial resources, time management, meal plans, and housing location/amenities. These findings highlight a need for screening, education, and intervention to address FI among collegiate athletes.

**Keywords:** food Insecurity; food security; collegiate athlete; student-athlete

## 1. Introduction

Despite national concerns regarding food insecurity (FI), which affects 12.8% of the U.S. population, it remains a significantly underestimated issue among college students (Rabbitt, 2022). Food insecurity often goes undetected among college students, particularly amidst the demands of academia and the transition to independent living. Studies reveal that, on average, approximately 30% of college students experience FI during their academic careers, a rate more than double the national average (Adamovic et al., 2022; Bruening et al., 2016; Douglas et al., 2022; Larin, 2018; Loofbourrow & Scherr, 2023; Rabbitt, 2022; Reader et al., 2022). Further research across diverse institutions identifies additional groups at greater risk for FI including those living in urban communities, students of color, Pell Grant recipients, athletes without meal plans, first-generation students, and those with pre-existing FI (Brown et al., 2023; Chimera et al., 2023).

Within the vulnerable population of college students are student-athletes. National surveys reveal significant FI among college athletes; The Hope Center's Real College Survey found that 24% of Division I athletes experience FI, with higher rates in Division II (26%), and two-year colleges (39%) (Goldrick-Rab et al., 2020). Student-athletes face unique barriers to food access due to demanding academic and athletic schedules, specialized dietary needs, and regular travel away from home. Balancing demanding academic and athletic schedules poses a unique challenge for college athletes, often impacting their ability to access adequate nutrition to fuel their sports performance (Anziano & Zigmont, 2023; Brauman et al., 2023; Brown et al., 2023). Although various factors influence food

access for all college students, recognizing the distinct challenges faced by student-athletes is crucial for developing effective interventions tailored to this specific demographic.

Collegiate athletes are at even greater risk of FI particularly due to the increased energy demands associated with physical performance. The reduced caloric intake, specifically of nutrient-dense foods, associated with FI can impair athletic performance and potentially increase injury risk (Hickey et al., 2019). Moreover, FI-related decreases in energy and nutrient intake raise the risk of Relative Energy Deficiency in Sport (REDs), contributing to physical and psychological harm in athletes (Langhans, 2022). This vulnerability emphasizes the urgent need for research on FI in college athletes. Despite growing awareness of FI among college students, this unique population with specific nutritional challenges has been largely overlooked.

Understanding the distinct barriers to adequate nutrition faced by college athletes compared to the general student population is essential for tailoring effective interventions. While comprehensive studies exist for non-athlete students, a critical knowledge gap remains regarding FI among college athletes. This scoping review aims to shed light on the prevalence of FI in college athletes, explore the specific factors contributing to this issue within their unique context, and offer prospective solutions to mitigate FI in this population. Through this investigation, we seek to: 1) elucidate the prevalence of FI among college athletes from a variety of institutions; 2) identify the specific contextual factors that contribute to FI in this cohort; and 3) propose target solutions to mitigate FI and its negative consequences. Addressing these issues will not only directly benefit college athletes but also inform our broader understanding of FI within higher education.

## **2. Materials and Methods**

### *2.1. Search Strategy*

All procedures for the scoping review were conducted based on guidelines within the JBI Manual for Evidence Synthesis ("Chapter 11," 2020). The protocol for the review was registered on August 22nd, 2023, and is publicly available on the Open Science Framework register. A total of three databases were used for the initial identification of primary research articles: 1) PubMed/Medline; 2) EBSCOHost; and 3) GoogleScholar. In each database, every combination of the following keywords was used: "food insecurity [mesh]" in combination with "athlete [mesh]" and "university [mesh]." To identify gray literature (unpublished reports of studies), theses/dissertations, abstracts, and newspaper articles were included in the database searches. To extend the comprehensiveness of searches, citations selected for full-text review were also used for a reference list search (backward reference search) and cited reference search (forward reference search). All database searches, reference searches, and author communications were conducted between August 2023 and February 2024.

### *2.2. Study Eligibility Criteria*

Eligibility criteria were constructed with the following inclusion criteria: 1) college students in the United States; 2) collegiate athletes (including NCAA and others); 3) examination of food insecurity. The title and abstract results from the systematic searches were independently screened by two researchers and those meeting the eligibility criteria underwent a full-text review. The full texts of all citations considered for further review were screened independently by two researchers based on the inclusion criteria. Any discrepancies were considered by a third researcher acting as a tiebreaker. Records were reviewed and organized to represent individual study samples. While eighteen records reported on studies that met the eligibility criteria, only eight were included as primary, peer-reviewed, original research articles. An additional ten resources were included as gray literature, including theses, dissertations, and abstracts (Figure 1).

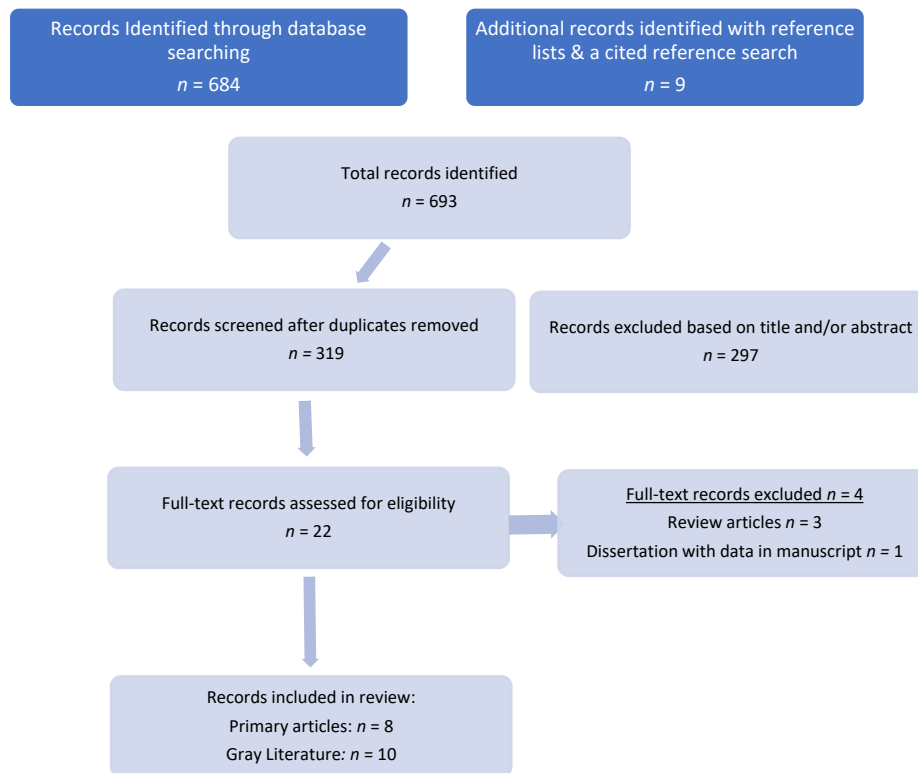


Figure 1.

### 2.3. Data Extraction

Data were extracted from each study and independently checked for accuracy by one other researcher. Using a standardized form, extracted characteristics included authors, publication year, gray literature or peer-reviewed source, year/month of data collection, study design, study population, sampling and recruitment strategies, sample size, sample demographics, size and location of university, FI measurement tool, FI reference period, medium (online, in-person, etc.) of FI assessment, prevalence of FI, and contributors to FI.

## 3. Results

### 3.1. Study Characteristics

The basic characteristics of the eighteen studies which met all eligibility criteria are outlined in Table 1. Less than half of the studies were considered primary articles, while the majority (56%) of included studies were gray literature, which include academic theses and dissertations. All publications included in this review are cross-sectional and sample sizes ranged from 10 to 3506 participants with a median of 88/study. To understand the prevalence of and main contributors to FI, the results include institution types, participation demographics, and the tools used to collect and assess FI.

**Table 1.** Description of Included Studies (n= 18).

Citation	Type of institution	Participant demographics	Tool to assess FI	Prevalence of FI	Contributors to FI
Peer-Reviewed Articles					

Anziano & Zigmont, 2023	-Public university -New England	<ul style="list-style-type: none"> <li>NCAA athletes (division not noted)</li> <li>N = 10</li> <li>Food insecure</li> <li>White: 90%</li> <li>Females: 50%</li> <li>On campus: 80.0%</li> </ul>	<ul style="list-style-type: none"> <li>6-item US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>100%: only surveyed those with FI</li> </ul>	<ul style="list-style-type: none"> <li>Lack of time</li> <li>Special dietary needs</li> <li>Limited campus dining options</li> <li>Lack of healthy options in dining hall</li> <li>Limited kitchen access</li> <li>Limited access to transportation</li> </ul>
Brown et al., 2023	-Multiple institutions -Unspecified location and type	<ul style="list-style-type: none"> <li>NCAA DIII</li> <li>N = 787</li> <li>Female: 63.3%</li> <li>White: 81.5%</li> <li>1st generation: 19%</li> <li>Pell recipient: 18.2%</li> <li>Live on campus: 81%</li> <li>Have meal plan: 83.3%</li> <li><u>Family Income:</u> <ul style="list-style-type: none"> <li>&lt;\$25,000: 5.4%</li> <li>\$25,000–49,999: 6.5%</li> <li>\$50,000–74,999: 16.5%</li> <li>\$75,000–99,999: 12.9%</li> <li>\$100,000+: 39.8%</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>5 questions from 6-item US-HFSSM &amp; 17 Researcher-created questions</li> </ul>	<ul style="list-style-type: none"> <li>Overall: 14.7%</li> <li><u>By ethnicity:</u> <ul style="list-style-type: none"> <li>White: 13.3%</li> <li>Hispanic: 18.3%</li> <li>Black: 31%</li> <li>Asian: 8.5%</li> <li>NHPI: 100%</li> </ul> </li> <li><u>By meal plan:</u> <ul style="list-style-type: none"> <li>With: 11.5%</li> <li>Without: 29.9%</li> </ul> </li> <li><u>By Pell Grant:</u> <ul style="list-style-type: none"> <li>Yes: 26.5%</li> <li>No: 11.1%</li> </ul> </li> <li><u>First Generation:</u> <ul style="list-style-type: none"> <li>Yes: 27.2%</li> <li>No: 11.3%</li> </ul> </li> <li><u>FI before college:</u> <ul style="list-style-type: none"> <li>Yes: 52.5%</li> <li>No: 11.5%</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Games during dining hours</li> <li>Living off campus &amp;/or limited money</li> <li>Practice during dining hours</li> <li>Regulation and restriction of feeding in DIII</li> </ul>
Daniels & Hanson, 2021	-Public land-grant research university -Kansas	<ul style="list-style-type: none"> <li>Army ROTC cadets</li> <li>N = 37</li> <li>Female: 30%</li> <li>White: 86.5%</li> </ul>	<ul style="list-style-type: none"> <li>6-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>27%</li> </ul>	<ul style="list-style-type: none"> <li>Social Access</li> <li>Personal</li> </ul>

Douglas et al., 2022	-Public university -Rural, east Texas	<ul style="list-style-type: none"> <li>NCAA DI</li> <li>N = 78</li> <li>Female</li> <li>White: 75.6%</li> </ul>	<ul style="list-style-type: none"> <li>6-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>32%</li> </ul>	<ul style="list-style-type: none"> <li>Timing of practice</li> <li>Limited dining hall hours</li> <li>Lack of financial resources</li> <li>Lack of cooking skills &amp; equipment</li> </ul>
Goldrick-Rab et al., 2020	171 2-year & 56 4-year institutions across the US	<ul style="list-style-type: none"> <li>13 NCAA DI</li> <li>11 NCAA DII</li> <li>24 NCAA DIII</li> <li>124 2-Year Colleges</li> <li>N = 3506</li> </ul>	<ul style="list-style-type: none"> <li>18-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>DI: 24%</li> <li>DII: 26%</li> <li>DIII: 21%</li> <li>2-Year Institutions: 39%</li> </ul>	<ul style="list-style-type: none"> <li>Limited financial resources</li> </ul>
Hickey et al., 2019	-Public liberal arts university -New Hampshire	<ul style="list-style-type: none"> <li>NCAA DIII</li> <li>N = 371 (not all athletes)</li> <li>Female: 65.8%</li> <li>Athletes: 78.17%</li> <li>White: 89.8%</li> <li>Have a meal plan: 80.8%               <ul style="list-style-type: none"> <li>1st generation: 24.9%</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Hunger survey developed specifically for the study</li> </ul>	<ul style="list-style-type: none"> <li>34.6%</li> </ul>	<ul style="list-style-type: none"> <li>None reported</li> </ul>
Poll et al., 2020	-Public research university -Mississippi	<ul style="list-style-type: none"> <li>NCAA DI</li> <li>N = 111</li> <li>Male</li> </ul>	<ul style="list-style-type: none"> <li>Childhood History of Food Insecurity Questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>9.9%</li> </ul>	<ul style="list-style-type: none"> <li>FI before college</li> </ul>
Reader et al., 2022	-State University -Northwest US	<ul style="list-style-type: none"> <li>NCAA DI</li> <li>N = 45</li> <li>Female: 73.33%</li> <li>White: 68.89%</li> <li>On campus: 44.4%</li> </ul>	<ul style="list-style-type: none"> <li>10-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>60%</li> </ul>	<ul style="list-style-type: none"> <li>Balancing academics &amp; athletics</li> <li>Elevated energy needs</li> <li>COVID-19</li> <li>Living location</li> <li>Lack of financial resources</li> </ul>
Abstracts					
Chimera et al., 2022	-Public university in rural North Carolina & Public research university in	<ul style="list-style-type: none"> <li>NCAA DI</li> <li>None reported</li> </ul>	<ul style="list-style-type: none"> <li>10-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>50%</li> </ul>	<ul style="list-style-type: none"> <li>Greater in urban vs rural</li> </ul>



	urban Alabama					
Dellana et al., 2023	-Public university in rural North Carolina & Public research university in urban Alabama	<ul style="list-style-type: none"> <li>• NCAA DI</li> <li>• N = 404</li> <li>• LGBTQ+: N = 24</li> </ul>	<ul style="list-style-type: none"> <li>• 10-item survey US- HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 45.6%</li> </ul>	<ul style="list-style-type: none"> <li>• None reported</li> </ul>	
Gagnon et al., 2023	-Not reported	<ul style="list-style-type: none"> <li>• N = 124</li> <li>• Female: 55%</li> <li>• White: 66%</li> </ul>	<ul style="list-style-type: none"> <li>• Researcher developed survey</li> </ul>	<ul style="list-style-type: none"> <li>• 65%</li> </ul>	<ul style="list-style-type: none"> <li>• Financial insecurity</li> <li>• Dining hall hours</li> <li>• COVID isolation</li> </ul>	
Mayeux et al., 2020	-Public university in rural east Texas	<ul style="list-style-type: none"> <li>• NCAA (no division noted)</li> <li>• N = 91</li> <li>• Female: 85.7%</li> <li>• White: 67%</li> </ul>	<ul style="list-style-type: none"> <li>• 6-item survey US- HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 39.6%</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of financial resources</li> <li>• Lack of time</li> </ul>	
Poll et al., 2017	-University in southeast	<ul style="list-style-type: none"> <li>• NCAA DI</li> <li>• N = 93</li> <li>• Male</li> <li>• White: 48.4%</li> </ul>	<ul style="list-style-type: none"> <li>• 6-item survey US- HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 16%</li> </ul>	<ul style="list-style-type: none"> <li>• None reported</li> </ul>	
Theses/Dissertations						
Anziano, 2020	-Public university in Connecticut	<ul style="list-style-type: none"> <li>• NCAA DII</li> <li>• N = 18</li> <li>• White: 88.9%</li> <li>• Live on campus: 83.3%</li> <li>• Female: 50%</li> </ul> <p><u>Hours worked per week:</u></p> <ul style="list-style-type: none"> <li>• 0: 66.7%</li> <li>• 1–12: 22.2%</li> <li>• 12+: 11.1%</li> </ul> <p><u>Financing college:</u></p> <ul style="list-style-type: none"> <li>• Self-pay: 27.8%</li> <li>• Scholarships/ grants: 55.6%</li> <li>• Loans: 38.9%</li> <li>• Assistance from others: 50%</li> </ul> <p><u>Meal plan:</u></p> <ul style="list-style-type: none"> <li>• None: 5.6%</li> <li>• Unlimited: 61.1%</li> <li>• Declining balance: 33.3%</li> </ul>	<ul style="list-style-type: none"> <li>• 6-item survey US- HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 44.4%</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of time</li> <li>• Family history</li> <li>• Spending priorities</li> <li>• Transportation</li> <li>• Limitations of dining halls</li> <li>• Meal plan</li> <li>• Limited kitchen access</li> <li>• Lack of assistance from coaches/universities</li> </ul>	

Bowman, 2020	-Private Catholic university in Pennsylvania	<ul style="list-style-type: none"> <li>• NCAA DII</li> <li>• N = 31</li> <li>• First generation</li> <li>• Male: 71%</li> <li>• White: 55%</li> </ul>	<ul style="list-style-type: none"> <li>• 10-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 40%</li> </ul>	<ul style="list-style-type: none"> <li>• Older students</li> <li>• Male</li> <li>• Female</li> </ul>
Misener, 2020	-Private liberal arts college in northeast	<ul style="list-style-type: none"> <li>• NCAA DIII</li> <li>• N = 424</li> <li>• Female: 46.5%</li> <li>• White: 79%</li> </ul>	<ul style="list-style-type: none"> <li>• 6-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 31.8% - in season</li> </ul>	<ul style="list-style-type: none"> <li>• Greater in male vs female</li> <li>• Greater in white vs non-white</li> <li>• Based on sport</li> <li>• Ran out of money for swipes</li> <li>• Ran out of money for campus food court</li> <li>• Unable to afford balanced meals</li> <li>• Correlated with receiving grant money</li> <li>• Correlated with being first generation</li> </ul>
Nilsson, 2023	-University in southwest	<ul style="list-style-type: none"> <li>• NCAA (division not noted)</li> <li>• N = 70</li> <li>• Female: 56.25%</li> </ul> <p><u>Living location:</u></p> <ul style="list-style-type: none"> <li>• Campus housing: 28.13%</li> <li>• Off-campus, walking distance: 26.56%</li> <li>• Off-campus, driving distance: 45.31%</li> </ul>	<ul style="list-style-type: none"> <li>• 10-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• Not reported</li> </ul>	<ul style="list-style-type: none"> <li>• Dining hall hours conflict with practice/game times</li> <li>• Living location</li> <li>• Limited resources (money)</li> </ul>
Stowers et al., 2022	-University in southeast	<ul style="list-style-type: none"> <li>• NCAA DI</li> <li>• Football players</li> <li>• N = 85</li> <li>• Male</li> </ul>	<ul style="list-style-type: none"> <li>• 10-item survey US-HFSSM</li> </ul>	<ul style="list-style-type: none"> <li>• 63%</li> </ul>	<ul style="list-style-type: none"> <li>• Greater in black vs white</li> </ul>

Note: FI = food insecurity; 6-/10-/18-item US-HFSSM = U.S. Household Food Security Survey Module: 6-/10-/18-Item Short Form (USDA ERS - Survey Tools, n.d.); NHPI = Native Hawaiian/Pacific Islander.

### 3.2. Institution Types

Overall, the majority of the included studies were conducted at NCAA institutions (n=16), with one reporting on army ROTC cadets, and another with no description of the type of university. Of the sixteen studies including NCAA institutions, seven focused on DI, two focused on DII, three were completed at DIII institutions, and four included multiple divisions or did not note a specific division. Furthermore, nine studies occurred at public universities, two at private institutions, and three reported on students from multiple institutions. Four of the reported studies did not include information about the type of institutions where research was conducted. The locations of institutions



were throughout the United States, including the northeastern states (n=5), southwest region (n=3), southeastern region (n=3), northwest (n=1), and Midwest (n=1), with one study not reporting location and four reporting on multiple institutions.

### 3.3. Participant Demographics

The demographic information included race/ethnicity, sex, sexual orientation, housing situation, income, meal plan access, and first-generation student status. Although three studies reported on all males, one reported on all females, and three did not include information regarding sex, 47% of the participants self-reported as female, and, among the twelve studies that reported race and ethnicity, the median was 77.3% white students. One study reported the sexual orientation of their students, which included LGBTQ+ individuals. Of the five studies examining housing, the majority of participants lived on campus, with a median of 80% living on campus. Three studies assessed the relationship between FI and first-generation students, with Bowman et al. (2020) reporting solely on first-generation college student-athletes. Additionally, three studies examined meal plan status and found on average that 86.2% have a meal plan.

### 3.4. Assessment Tools for FI

The USDA screens individuals for FI by analyzing results from food security survey modules (*USDA ERS - Survey Tools*, n.d.). The 18-item U.S. Household Food Security Survey Module (US-HFSSM) is a three-stage survey that allows for minimal respondent burden with the benefit of reliable data. In addition to this screening tool, a 10-item U.S. Adult Food Security Survey Module, and a 6-item Short Form of the Food Security Survey Module provide a more condensed version of the survey. Goldrick-Rab et al. (2020), utilized the 18-item survey, while four studies employed the 10-item survey, and eight studies used the 6-item survey. In addition to the US-HFSSM, Brown et al. (2023) utilized a series of research-created questions for students to answer regarding FI, while Hickey et al. (2019) utilized a hunger survey developed specifically for assessing food security. Poll et al. (2020) used a questionnaire on the childhood history of FI to gather further information on food security status.

### 3.5. Prevalence

Apart from one study highlighting only students identifying as food insecure, one describing the prevalence based on type of institution, and another not reporting FI prevalence, fifteen reported a range of FI from 9.9% to 63%, with a median of 39.6% of participants identifying as food insecure. The lowest prevalence rate, reported at 9.9%, was observed among male-only participants attending the University of Mississippi, an NCAA DI institution, and the highest rate, 63%, was also observed among male-only participants attending an NCAA DI institution located in the southeastern United States. Furthermore, Brown et al. (2020) identified trends in FI, with the greatest rates among participants identifying as Native Hawaiian or Pacific Islander (100%), without a meal plan (29.9%), receiving a Pell grant (26.5%), first-generation (27.2%), and having a history of FI before college (52.5%). Lastly, Goldrick-Rab et al. (2020) found the prevalence of FI to be greater among those attending two-year institutions (39%) compared to DI (24%), DII (26%), and DIII (21%) institutions.

### 3.6. Contributors

The most significant contributors to FI included limited financial resources, time management, and housing location/amenities. Overall, 50% of studies reported limited financial resources as their primary cause for FI. Time management was another major contributor, with 44.4% of studies reporting that athletic commitments disrupted mealtimes and the ability to access campus dining resources. Lastly, 38.8% of the included studies reported location of dining facilities and/or access to kitchen amenities and 22.2% reported lack of options for specific dietary needs as the most substantial hurdle to food security.

Other less commonly reported contributing factors to FI included race/ethnicity (11.1%), sex (11.1%), age (5.6%), sport (5.6%), history of FI (11.1%), social/access/personal factors (5.6%), location (5.6%), meal plan (11.1%), assistance from coaches and institution (5.6%), being first-generation (5.6%), identifying as a Pell grant recipient (5.6%), NCAA policy changes in the regulation of feeding among DIII institutions (5.6%), and the change in campus routines during and following COVID-19 (11.1%).

#### 4. Discussion

The review aims to shed light on the prevalence of FI among college athletes, explore the specific factors contributing to this issue within their unique context, and offer prospective solutions to alleviate and prevent further FI among this population. Overall prevalence rates ranged from 9.9% to 65%. Food insecurity rates were primarily captured using the US-HFSSM 18-, 10-, and 6-item surveys. The results indicate that the most reported contributors to FI among athletes included limited financial resources (50%), limited time (44.4%), location of eateries (38.8%), and lack of options for dietary needs (22.2%). Evidence of FI among these universities highlights the need for immediate intervention.

##### 4.1. Financial Challenges

The demands of playing a college sport and managing finances are challenging tasks for student-athletes across all collegiate levels and types of universities. One study examining 91 female student-athletes found that 25% of participants reported limited finances as the primary barrier to adequate food intake (Mayeux et al., 2020). Similar studies have reported limited financial resources as the major contributor to FI for student-athletes (Anziano & Zigmont, 2023; Douglas et al., 2022; Gagnon et al., 2023; Goldrick-Rab et al., 2020; Mayeux et al., 2020; Misener, 2020; Reader et al., 2022). Student-athletes often face additional expenses, such as equipment and travel fees, that the general college population is not expected to pay, which may partly explain the financial challenges (Goldrick-Rab et al., 2020). To further compound the financial strain, the considerable time commitment to sports and academics often prevents collegiate athletes from working to earn more money.

The challenges of juggling an athletic schedule, coursework, and employment often force student-athletes to prioritize spending. As a result of financial prioritization, student-athletes may resort to eating less, skipping meals, or eating more affordable but less nutritious meals (Anziano & Zigmont, 2023; Gagnon et al., 2023; Goldrick-Rab et al., 2020; Misener, 2020; Reader et al., 2022). Based on results from a food security questionnaire, 72% of participants stated they often or sometimes worried about food running out before obtaining enough money to buy more, 73% stated they often or sometimes felt that the food they bought did not last because there was not enough money to get more, and 38% stated they were hungry but avoided eating because there was not enough money to buy more food (Nilsson, 2023).

These results demonstrate how the overall intake of nutritious and balanced meals among student-athletes is often sacrificed to save money. A survey conducted in the California University system found that food-insecure students were more likely to purchase food based on cost and not nutritional quality when compared to food-secure students (Martinez et al., 2018). An additional study found that 55% of polled student-athletes were not able to afford balanced meals due to their limited financial resources (Nilsson, 2023). Even with the help of scholarships, and supplemental food assistance program participation, these factors which have been linked to assisting lower-income individuals, are not protective enough to prevent FI among students (Mayeux et al., 2020). While the prevalence of student-athletes receiving aid has not been investigated, Goldrick-Rab et al. (2020) found that 18% of college students received food assistance benefits despite the significant list of eligibility criteria, including working at least 20 hours per week, being a single parent, or participating in on the job training (Goldrick-Rab et al., 2020; *SNAP Eligibility | Food and Nutrition Service*, 2023).

#### 4.2. Meal Plans

Meal plans are often not effective enough on their own to prevent FI among college athletes (Dubick et al., 2016). A study that looked at FI among four-year colleges reported a staggering prevalence of 43%, even though students had access to a meal plan and campus dining locations (Dubick et al., 2016). Out of students enrolled in the meal plan option, those reporting higher rates of FI reported consuming fewer meals in the dining hall compared to their peers, with 69% of participants eating nine or fewer meals in a dining hall each week (Dubick et al., 2016). The same report also found that individuals consuming 5-9 meals per week at a dining hall reported 7% higher rates of FI compared to individuals who consume fewer than five meals per week, which shows that the number of meals per week and meal plans alone are not predictive of FI (Dubick et al., 2016). Lower rates of meals consumed per week while on a meal plan may decrease because off-campus students use swipes on top of purchasing groceries and cooking at home. One of the main concerns is that while some students can utilize on-campus dining locations, not all universities provide affordable meal plans (Mayeux et al., 2020; Misener, 2020). Historically, research on college meal plans and dining options has focused on college students. As a result of limited research, similar rates among college athletes can be assumed.

#### 4.3. Time

While every student is responsible for time management, student-athletes face the additional challenge of managing their rigorous academic and athletic schedules and obligations, which has been shown to increase the rates of FI. Due to their commitment to athletics (e.g., practice, travel, and competitions), college athletes have less time for employment opportunities and mealtimes (Douglas et al., 2022). With these factors to consider, athletes must prioritize their mealtimes, which can be challenging, especially when many dining halls have limited hours of operation. Competition and practice times were often reported as interfering with dining hall hours, preventing athletes from accessing healthy meals on campus during appropriate mealtimes (Anziano & Zigmont, 2023; Brown et al., 2023; Douglas et al., 2022; Gagnon et al., 2023; Mayeux et al., 2020; Nilsson, 2023; Reader et al., 2022).

Many students struggle to find enough time in their schedules to prioritize grocery shopping, cooking, and eating because of their busy academic and athletic schedules (Anziano & Zigmont, 2023). Even though many athletes have a meal plan, they often report being too busy or too tired to cook for themselves (Anziano & Zigmont, 2023). Among a cohort of 787 student-athletes, 45.4% reported that practice hours interfered with dining hours, and 22% reported that game times interfered with dining hours (Brown et al., 2023). Student-athletes must obtain the appropriate number of calories to fuel their daily needs, including a demanding physical component. Even though athletes may understand their need to eat for sport, achieving those needs may be especially challenging due to their demanding schedules and the limited mealtimes provided by the institution.

#### 4.4. Housing

The living environment of student-athletes also plays a significant role in the risk of FI. For those living off campus, the cost of rent in addition to other living expenses may increase the risk of FI. Living off campus with limited finances was reported as a major barrier to adequate food access for student-athletes (Reader et al., 2022). Additionally, the increase in regional off-campus housing costs over the last few years may be related to the increased prevalence of FI among student-athletes (Reader et al., 2022). Similarly, on-campus housing comes with an additional set of challenges. Dormitories and on-campus living quarters offer varying types of living arrangements and amenities which can influence students' food security status. Students living on campus at a public university in New England reported limited access to a kitchen as one of many contributing factors to FI, as they must go out of their way to access resources associated with cooking and preparing meals (Anziano & Zigmont, 2023; Douglas et al., 2022). While some of the dorms offer amenities specific to cooking and preparing meals, this resource is not always guaranteed and is unique to each university.

Surrounding campus resources such as grocery stores and eateries should be considered when observing FI rates among student-athlete populations. A study assessing campus location and rates of FI found that the incidence of very low food security was two times greater in an urban compared to a rural setting (Chimera et al., 2023). Access to healthy food is also significantly impacted by the neighborhoods and surrounding environment. Food deserts are often located where there are smaller populations, elevated rates of abandonment or deserted homes, and residents with limited education, lower income, and higher unemployment (Foundation, 2021).

#### 4.5. COVID-19

Lack of access to nutritious and readily available food was heightened as students navigated life during the COVID-19 pandemic. Among 2,018 college students, 15% were newly FI as a direct result of the pandemic (Hagedorn et al., 2022). The drastic lifestyle changes that occurred for Americans during the pandemic, also contributed to major shifts in the day-to-day lives of college-athletes, potentially increasing the risk for FI. COVID-19 safety precautions led to the closing of athlete fueling stations, reducing access to free and healthy snacks (Reader et al., 2022). Additionally, campus closures during the pandemic directly resulted in a decline in food production and access to healthy foods, which placed those already experiencing FI in a more vulnerable position (Pereira & Oliveira, 2020). In response to campus closures, students returned home, which may have negatively or positively impacted their access to food, depending on the existing factors at home. While some students experienced lower rates of FI when moving back home, this was not the same situation for those living independently. For students living independently, FI rates increased along with stress levels, poor health status, and hours worked (Davitt et al., 2021). The pandemic exacerbated the challenges college student-athletes were already facing while navigating living independently and brought a level of awareness to the public regarding FI among this population. Post-pandemic findings identified a widespread impact of FI on students' overall health, wellness, and academic and athletic performance (Anziano & Zigmont, 2023; Brown et al., 2023; Gagnon et al., 2023; Mayeux et al., 2020; Nilsson, 2023; Reader et al., 2022). Given the connection between the pandemic and rates of FI, future studies may demonstrate the lasting impacts the pandemic had on student-athletes access to adequate nutrition.

#### 4.6. Impact of FI among Student-Athletes

The impact of FI on student-athletes has not been thoroughly examined, yet previous research highlighting FI among college students in general provides some information. Approximately 66% of student-athletes agreed that access to food and snacks would increase overall academic and athletic performance (Mayeux et al., 2020). A specific concern for student-athletes is REDs, a common issue among athletes who do not consume enough calories. Low energy consumption can contribute to hormonal and menstrual alterations, reduced physical performance, decreased concentration and coordination, depression, mood alterations, and injury (Reader et al., 2022). Additionally, many student-athletes do not have nutrition education from a qualified practitioner, such as a registered dietitian nutritionist (RDN), to help guide the types of foods appropriate for supporting and even enhancing performance goals (Eck & Byrd-Bredbenner, 2021). Subsequently, if athletes fail to meet their energy needs, they risk suboptimal performance and injury, which may result in less playing time and potential loss of scholarship.

#### 4.7. Intervention Strategies

To better support student-athletes and diminish the prevalence of FI, campus interventions have been deemed an appropriate place to start. One basic primary step that team coaches can take is to screen for FI before athletes even arrive on campus. Coaches and staff can also use this screening as an opportunity to discuss the contributors to and risks of FI and provide resources to aid those in need. Some campuses have introduced screening programs to detect FI to proactively address the

situation, providing access to support staff who help with time management, thus providing options on where to eat and how to plan meals in response to their busy schedules (Douglas et al., 2022).

In response to the growing concern about FI on college campuses, The College & University Food Bank Alliance created a Student Government Toolkit Guide to provide directions for running a campus-led food pantry. This resource provides directions on how to allocate needs surveys to students, advice on partnering with regional food banks, setting up a pantry, and tips on operating a pantry (“Running an On-Campus Food Pantry,” n.d.). While there is no simple solution to solving FI on college campuses, providing accessible student-focused interventions such as the Student Government Toolkit Guide is a valuable resource to utilize when determining intervention strategies.

## 5. Conclusions

Overall findings of this scoping review show a significant prevalence of FI among college athletes. Among those experiencing FI, the primary contributors included limited financial resources, overwhelming time commitments, location of resources, and housing arrangements. Lesser reported contributors include limited kitchen access and cooking skills, increased energy needs, family history of FI, disordered eating, lack of support from family members or the university, and the COVID-19 pandemic. Research in this realm is crucial especially when advocating for policy change surrounding the needs of our collegiate athletes. While athletes continue their college journey, there is a need for up-to-date solutions to prevent the climbing rates of FI among athletes. Athletic programs are advised to implement screening tools and assessments to gauge athletes’ food security status and provide resources such as fuel stations, created specifically for athletes.

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