



Review

Navigating Food Insecurity in Higher Education: Using the Social Cognitive Theory to Identify Key Influences and Effective Interventions



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ABSTRACT

Food insecurity (FI) remains a significant crisis in the United States, disproportionately affecting college students at nearly 4 times the national household average. There are a multitude of competing factors that affect food security (FS) in college, thus making it difficult to design effective interventions. This scoping review aimed to provide a comprehensive overview of recent research exploring the diverse factors that impact FS among college students. Using the Social Cognitive Theory as a guiding framework, this review aimed to identify key influences on FI, address gaps in the literature, and highlight effective interventions that can enhance FS among this vulnerable population. This review highlights how personal/cognitive factors, behaviors, and environmental components shape college students' experiences with FI. There is a need for targeted interventions, resources, and policy changes that can help address FS-related challenges effectively in higher education.

Keywords: food security, college students, Social Cognitive Theory, coping strategies, food access, nutrition and food literacy

Introduction

Food insecurity (FI) is a widespread issue in the United States with far-reaching consequences [1]. Defined as a condition of limited or uncertain access to adequate food, FI is a critical determinant of both physical and emotional well-being [2]. As of 2023, 13.5% of United States households report experiencing FI annually. However, certain groups, such as college students, experience FI at rates higher than the national average [3,4]. Recent estimates of FI among college students vary widely ranging from 10% to 75% and is typically influenced by factors such as geographic location, institution type (public vs. private), and whether students attend 2-y or 4-y institutions [4–6]. Rates may also be affected by the type or version of the food security (FS) measurement tool used, as well as the method of its administration (e.g., online vs. paper based) [7,8]. Nationally, weighted estimates suggest that ~41% of college students experience FI [5]. This heightened risk may be driven by multiple factors unique to the American college experience,

including rising tuition and living costs, limited employment opportunities, and the challenge of managing newfound independence [9–11]. For many students, college represents their first experience with budgeting, meal planning, and managing both school and personal expenses on their own [9,12].

The effects of FI on college students are profound, with significant links to adverse physical and mental health outcomes, which include poor diet quality, disordered eating behaviors, and poor/fair self-reported health [13–15]. The financial and psychological pressures of college life can exacerbate these issues, with students experiencing FI reporting higher levels of stress and mental health problems [16,17]. Furthermore, academic performance can be negatively influenced, as students experiencing FI tend to have lower Grade Point Averages, higher dropout rates, and overall worse academic outcomes compared to their food-secure peers [13,18]. Given these negative consequences, understanding the factors that influence an individual's FS status is a critical first step in addressing this issue.

Abbreviations: AFSSM, Adult Food Security Survey Module; DACA, Deferred Action for Childhood Arrivals; FI, food insecurity/food insecure; FS, food security/food secure; SCT, Social Cognitive Theory; SNAP, Supplemental Nutrition Assistance Program; USDA, United States Department of Agriculture.

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Previous research has explored how various factors affect college students' ability to maintain or bolster their FS. For instance, nutrition knowledge has been identified as a key factor in helping improve FS. Multiple studies have identified a positive relationship between increased awareness of nutrition principles and better FS outcomes [19,20]. Beyond knowledge, food acquisition behaviors provide valuable insights into how college students manage their FS [21–23]. Within one's environment, factors, such as campus food pantries and meal programs, can provide crucial support in improving access, diet, and ultimately FS [24,25]. The present literature demonstrates the complexities of FS and highlights the need for thoughtful interventions and programming to support students experiencing FI. Food security is also shaped by multiple, interconnected factors, rather than a single challenge; therefore, examining this dynamic interplay is essential for gaining a deeper understanding of how these elements collectively shape FS outcomes in college students.

One avenue for exploring these relationships is based on the Social Cognitive Theory (SCT), which provides a critical framework for understanding these interactions by describing how individuals acquire, adapt, and maintain behaviors [26]. The SCT posits that individual behaviors are shaped by the dynamic interplay of personal/cognitive, behavioral, and environmental factors. A key concept of the SCT is reciprocal determinism, which emphasizes this continuous interaction highlighting how these components reinforce one another in shaping an individual's behavior. In addition to reciprocal determinism, the SCT emphasizes several other components that influence behavior, including self-efficacy, observational learning, reinforcement or self-control, and outcome expectations. Self-efficacy, or an individual's confidence in their ability to succeed, plays a crucial role in shaping behavior. Observational learning shapes and teaches behaviors, whereas reinforcement and self-control maintain behavioral patterns. Finally, outcome expectations, or beliefs about the consequences of certain actions, promote beneficial behavioral patterns. The SCT components provide a comprehensive framework for understanding and creating impactful interventions to influence behavior change. However, although the SCT is often used as a framework for developing interventions to drive positive behavioral change, it is essential to first examine the factors that shape the outcome. By identifying these underlying influences, a better understanding of what drives behavioral change can be derived, and more effective interventions to promote lasting improvements can be developed.

This scoping review offers a comprehensive overview of recent research examining the multifaceted factors influencing FS among college students. By employing the SCT as a guiding framework, this review aimed to identify effective strategies and address gaps within the literature to better understand and enhance FS among this vulnerable population [26]. The review highlights how personal/cognitive factors, behaviors, and environmental contexts interact to shape college students' experiences with FI and emphasizes the need for targeted interventions, resources, and policy changes that can empower college students to effectively address and navigate their food-related challenges.

Methods

This scoping review followed the guidelines outlined in the PRISMA.

Inclusion and exclusion criteria

This review selected peer-reviewed studies examining the relationship between personal/cognitive factors, behavior, and environment on FS status and related factors in college students. The literature published within the last 10 y (June 1, 2014–October 1, 2024) was systematically searched using PubMed and Google Scholar. The initial literature search was conducted in July 2024, followed by a gap search in October 2024 to ensure the inclusion of all pertinent studies. Title and abstract search terms were selected using the SCT as a framework and included “FS,” “FI,” “College,” “University,” “Coping,” “Student,” “Food Access,” “Environment,” “Perceptions,” “Skills,” “Knowledge,” “Literacy,” “Attitudes,” “Behaviors,” and/or “Self-efficacy.” Quantitative, qualitative, and multi- or mixed-method studies were included for extraction. Furthermore, studies of various designs, including cross-sectional, longitudinal, and intervention based, were included. The articles included were original research conducted in the United States at 2- or 4-y institutions. Dissertations, white papers, reviews, and publications consisting only of abstracts were excluded from the analysis.

As FS is the primary outcome of interest in this review, studies that did not measure this were excluded. In addition, articles were excluded if FS was measured using a tool other than the United States Department of Agriculture (USDA) Adult FS Survey Module (AFSSM) in any of its variations, including the 2-item, 6-item, 10-item versions, or the 18-item United States Household FS Survey Module. Although not specifically validated for use in the college student population, the USDA AFSSM is considered to be the present preferred method for assessing FS status in adults [7]. As such, studies that used alternative measurement tools were not included in this review to ensure consistency and comparability across findings. As the primary aim of this review was to examine the relationship between selected SCT factors and FS status, studies that did not investigate their relationship or impact of these variables were excluded. Although COVID-related articles were not explicitly excluded, most focused on the pandemic's impact on behaviors or FS status in isolation rather than examining their interaction. As a result, nearly all such studies were excluded. Figure 1 illustrates the article selection process via a PRISMA diagram.

Results

Using the Covidence platform, 1043 articles were initially identified. After duplicates were removed, the resulting total was 576. One researcher (E.S.) screened the articles, identifying 114 for full-text review. Potential eligible articles were independently reviewed by 2 researchers (E.S. and R.E.S.), with final inclusion determined after discussion of any discrepancies, which led to a total of 53 articles included within the scoping review. Data were extracted by ES and verified by RES for accuracy and included sample size, participant characteristics, USDA AFSSM version, and key outcomes (Table 1) [9,11,14,19–25,27].

Research was categorized based on the SCT using the principle of reciprocal determinism as a framework for classification (Figure 2) [9,11,14,19–25,27–69]. Studies focusing on the role or intervention of knowledge, perceptions, or personal beliefs

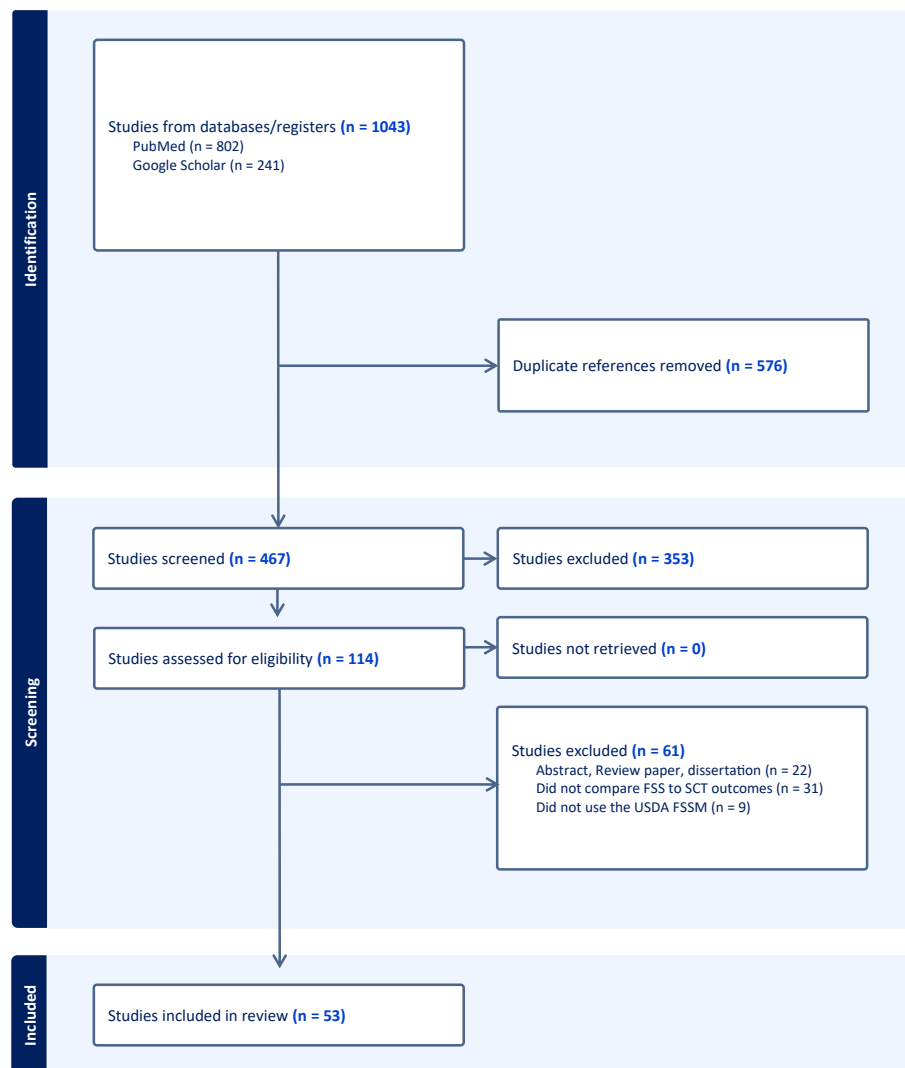


FIGURE 1. PRISMA diagram depicting the literature screening and selection process. FSS, Food Security Survey; SCT, Social Cognitive Theory; USDA, United States Department of Agriculture.

were grouped under the “personal factors” category. Research that described behaviors, self-efficacy, and skills, such as meal planning, budgeting, or food preparation, was categorized within the “behavior” category. Finally, studies examining the influence of the environment on FS, including food acquisition, food resources, social support, or campus food programs, were classified in the “environment” category. If a study addressed 1 or more determinants of the SCT, it was classified under multiple SCT components.

Of the 53 studies reviewed, most ($n = 33$, 62%) employed quantitative methods, whereas a smaller portion ($n = 11$, 21%) used multi- or mixed-methods study, and the fewest ($n = 9$, 17%) used qualitative data. The included studies were conducted in diverse geographic locations across colleges and universities in the United States. The primary objective of these studies was to examine the complexities of FI among college students, with many exploring how factors, such as personal/cognitive components, environmental influences, and behaviors, are linked to student outcomes or characteristics.

Personal or cognitive factors

Twenty-one studies explored the relationship between FS and personal/cognitive factors, yet the specific outcomes of interest examined varied among these studies. Seven studies investigated the role of knowledge [19,20,25,28,34,46,67], whereas 15 studies explored students’ attitudes, perceptions of need, and perceptions of their FS classification.

Knowledge

To investigate the role of knowledge on FS, the majority of the included studies employed a quantitative cross-sectional design ($n = 4$) [20,25,34,46]. Two studies used qualitative methods [28, 67], whereas 1 study used a multi-method approach [19]. The multi-method study included an intervention in which students participated in a course aimed at improving their cooking, food preparation skills, and food literacy knowledge [19]. Across the 7 studies, various modules and questionnaires were used to measure knowledge. These included author-generated items on topics such as MyPlate

TABLE 1

Summary of studies investigating factors influencing food security status through the lens of the Social Cognitive Theory.

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Navigating Hidden Hunger: An Exploratory Analysis of the Lived Experience of Food Insecurity among College Students [27]	Anderson et al., 2022	n = 30	University of Tennessee, Knoxville: Female: 70% Non-White: 30% First generation: 54% FI: 100%	Qualitative Cross-sectional	1. 6-item AFSSM	Behavior Environment Personal/ cognitive factors	1. Meaning of FI 2. Impact of FI on lived experience 3. Impact of FI on coping strategies and food decisions 4. Food access	Facilitators of food access were coping strategies, social networks, and food access resources. Barriers included stigma around food access resource use: specifically, stigma around asking for help and fear of taking away from others in greater need.
Exploration of Dietary Beliefs and Social Cognitive Factors that Influence Eating Habits Among College Students Attending a Rural Midwestern University [28]	Birmachu et al., 2023	n = 49	University of Wisconsin-Stout Female: 75.5% Non-White: 12.2% FI: 22.3%	Qualitative Cross-sectional	1. 10-item AFSSM	Personal/ cognitive factors	Main themes identified: 1. Food and health beliefs 2. Social influence on diet 3. University influence 4. Body image beliefs	Students used their nutrition knowledge to guide their food choices. In addition, students discussed barriers to healthy eating and the influence of their environment on their food choices.
Understanding Coping Mechanisms: An Investigation into the Strategies Students Use to Avoid, Manage, or Alleviate Food Insecurity [22]	Brescia and Cuite, 2019	Quantitative (n = 6823) Qualitative (n = 1375)	Rutgers University Female: 64.9% Non-White: 59.7% Pell Grant: 37.7% FI: 36.9%	Multimethod Cross-sectional	1. 10-item AFSSM 2. Coping strategy survey 3. Food sufficiency questions 4. Food access resource use questions	Environment Behavior Personal/ Cognitive Factors	1. FI = ↑ Coping strategy use compared to FS students 2. FI = ↑ Disordered eating based coping strategy use 3. Students worried about using food access resources in fear of taking away from others	Many students were reluctant to use food access resources due to shame, fear of taking away from others, and the belief that they should be self-reliant. To cope, they adopted strategies such as budgeting, prioritizing paychecks, using credit cards, and purchasing low-cost or ultraprocessed foods. Additionally, students often felt stigmatized and feared being judged for their FI.
College Campus Food Pantry Program Evaluation: What Barriers Do Students Face to Access On-Campus Food Pantries? [29]	Brito-Silva et al., 2022	n = 529	Texas Woman's University, Denton Female: 93.9% Non-White: 59.9% FI: 49.2%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Food access resource use, awareness, and perceptions questions	Environment	1. FI = ↑ Food pantry use compared to FS students 2. 1 in 4 students noted barriers to accessing the on-campus pantries	Students experiencing FI used the on-campus food pantry more frequently than their FS peers. However, many students cited barriers such as stigma, transportation challenges, and limited access as factors that deterred or prevented them from utilizing the pantry.
Factors Associated with Food Security of Texas Woman's University Freshmen [30]	Brito-Silva et al., 2024	n = 73	Texas Woman's University Female: 94.9% Non-White: 65% FI: 54.2%	Multimethod Cross-sectional	1. 6-item AFSSM 2. Self-rated FS status 3. Self-reported cooking skills 4. Food literacy 5. FI focused open-ended questions	Personal/ Cognitive Factors Environment Behavior	Main themes: 1. Discrepancy existed between the 6-item AFSSM results and self-rated FS responses 2. FI students were more likely to overestimate their FS status 3. Potential solutions	There was a discrepancy between FS status as classified by the AFSSM and students' self-reported FS. Students noted that improved finances, food accessibility, and cooking skills could serve as potential solutions to address FI.
		n = 588			1. 6-item AFSSM	Behavior		

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Multi-Level Determinants of Food Insecurity Among Racially and Ethnically Diverse College Students [31]	Brown et al., 2023		University of South Florida, Tampa Female: 71.6% Non-White: 34.2% Pell Grant recipient: 49.5%	Quantitative Cross-sectional	2. K6 Psychological Distress Scale 3. Coping Strategy Scale 4. Cooking frequency 5. Perceived cooking skills		1. FI = ↑ Coping strategy use compared to FS students 2. No association between FS and cooking skills	A significant correlation was found between FI and the use of coping strategies, but no correlation was observed between FI and perceived cooking skills. Additionally, no differences in coping strategies were noted across racial or ethnic groups. Coping strategies related to saving money and reducing food intake were positively associated with FI.
Campus Food Pantry Use May Improve Daily Frequency of Fruit and Vegetable Intake Among California University Students Experiencing Food Insecurity [32]	Chodur et al., 2024	n = 1188	Across the 10 campus University of California system Female: 67.7% Non-White: 42.5% First-generation: 53.6% FI: 59%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Food access resource use 3. Daily Frequency of F/V Intake	Environment	1. Students with FI = ↓ F/V consumption 2. Food access use among FI individuals = ↑ F/V consumption 3. ↑ Food pantry use in FI vs FS students Covariates: Sex, age, student level, GPA, racial and ethnic status, and need-based financial aid	College food pantries can help students experiencing FI increase their F/V consumption.
SNAP For U: Food Insecurity and SNAP Use Among College Students, Including Institution Type Differences [33]	Chrisman et al., 2024	n = 844	9 Universities in Missouri Female: 60.5% Non-White: 26.3% FI: 44.9%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Food access resource use, knowledge, barriers and facilitators	Environment	1. Only 34% of eligible students knew they qualified for SNAP. 2. Main barriers to SNAP access: Limited knowledge, perceived ineligibility, stigma 3. Key facilitators of SNAP: university assistance, campus resources	Although most students were familiar with SNAP, many were unaware of their eligibility. Students experiencing FI were more likely to be informed about SNAP than their FS peers.
Addressing Food Insecurity: A Qualitative Study of Undergraduate Students' Perceptions of Food Access Resources [24]	Conrad et al., 2022	n = 58	Mississippi State University No demographic data provided	Qualitative Cross-sectional	1. 6-item AFSSM	Personal/ Cognitive Factors Environment Behavior	Three main themes that influence FS identified: 1. Personal beliefs and perceptions 2. Life skills and coping strategies 3. University resources and stigma	Personal beliefs, life skills, and the university are key influencers of college students' ability to cope with FI, each shaping their perspectives on food access resources.
Food Insecurity, Financial Priority, and Nutrition Literacy of University Students at a Mid-Size Private University [34]	Cuy Castellanos & Holcomb, 2018	n = 560	University of Dayton No demographic data provided FI: 35.8%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Financial priority questionnaire 3. New Vital Signs for health literacy (NVS) questionnaire	Personal/ Cognitive Factors Behavior	1. ↑ FS = ↑ Food literacy 2. ↑ Prioritization of alcohol and drugs = ↑ FI	Students who prioritized spending money on alcohol or tuition had a higher risk of experiencing FI. Food literacy and FS were positively correlated.

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Effects Of COVID-19 on University Students' Food Security [35]	Davitt et al., 2021	n = 1434	Iowa State University Female: 61.2% Non-White: 18.1% FI: 17%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Frequency/ types of meals consumed 3. Cooking self-efficacy	Environment Behavior	1. Students with FI = ↑ Likelihood of using the food pantry 2. Students with FI = ↑ Likelihood of eating microwavable/frozen meals, getting takeout, eating fast foods 3. ↑ FS = ↑Cooking self-efficacy	Students with FI reported that they were more likely to have limited time available to grocery shop and prepare food. Students facing FI are more likely to use the food pantry, eat microwavable/frozen meals, get takeout or go to get fast food, and are less likely to eat home-cooked meals.
Food Insecurity Among Students in Six Health Professions' Training Programs [36]	DeMunter et al., 2020	n = 1050	Oregon Health and Science University Female: 69.3% Non-White: 24.7% FI: 28.5%	Multimethod Cross-sectional	1. 6-item AFSSM 2. Food purchasing behaviors 3. Food budgeting questions	Environment Behaviors	1. Students with FI = ↑ Likelihood of eating lunch at home 2. Students with FI = ↑ Likelihood of skipping meals 3. Students with FI = ↑ Likelihood of using free food options Covariates: Race, ethnicity, age, marital status, and income	Students who were FI were more likely to skip meals or leave campus for lunch compared to their food-secure peers. They were also more likely to seek out free food and resources.
Why are Hungry College Students Not Seeking Help? Predictors of and Barriers to Using an On-Campus Food Pantry [37]	El Zein et al., 2018	Quantitative (n = 899), Qualitative (n = 68)	University of Florida Female: 74.3% Non-White: 22.4% Pell grant recipient: 22.9% FI: 31.5%	Multimethod Cross-sectional	1. 10-item AFSSM 2. Food access resource use, knowledge, and barriers	Personal/ Cognitive Factors Environment	Only 38% of FI students reported food pantry use. Main themes that influence FS identified: 1. Food access resource use 2. Perceived barriers to food access resources Covariates: Sociodemographic variables	Among students who did not use the pantry, the primary barriers were social stigma and embarrassment, lack of information about the program's operations and eligibility criteria, a perception that the pantry was not meant for them, and inconvenient hours of operation; notably, among those citing these barriers half of them were FI.
Prevalence and Correlates of Food Insecurity Among U.S. College Students: A Multi-Institutional Study [14]	El Zein et al., 2019	n = 855	8 Universities (FL, ME, TN, SD, KS, NY, AL, WV) Female: 68.8% Non-White: 37.6% Pell Grant recipient: 39.7% FI: 19%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Food access resource use and awareness 3. Eat Attitudes Test	Environment	1. ↑ Food assistance resource use among FI students vs FS students Covariates: Pell grant status, parental education, place of residence, and meal plan status, age, sex, university, and employment status	Although more than half of students experiencing FI were aware of food access resources on their campus, only ~1 in 5 used these services.
Obstacles to University Food Pantry Use and Student-Suggested Solutions: A Qualitative Study [38]	El Zein et al., 2022	n = 41	University of Florida Female: 70.7% Non-White: 53.7% Pell Grant recipient: 34.1% FI: 82.5%	Qualitative Cross-sectional	1. 10-item AFSSM 2. Food pantry use	Personal/ Cognitive Factors Environment Behavior	1. Barriers = ↓ Food access resource use 2. Limited knowledge = ↓ Food access resource use 3. Stigma/Perceived need = ↓ Food access resource use 4. Expressed need for events and courses to ↑ cooking skills	Although the pantry provides an essential service, factors, such as stigma, limited food variety, and long wait times, can hinder its accessibility and use.

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/measures	Main indicators	Key findings	Summary and conclusions
Differences in Measured and Self-Categorized Food Security Status and Related Coping Strategies Among College Students [39]	Engel et al., 2022	n = 1003	University of Florida Female: 65.7% Non-White: 32.2% Pell Grant recipient: 28.5% FI: 40%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Coping Strategy Scale 3. Self-categorized FS status	Personal/ Cognitive Factors Behavior	1. Only 42% of FI participants self-identified as FI 2. FI = ↑ Coping strategy use compared to FS students 3. FI Student who self-identified as FI = ↑ Coping strategy use compared to FI students that identified as FS 4. Students who self-identified as FS used the fewest coping strategies	Only 42% of FI participants self-identified as FI, leading to differences in coping strategy use. Individuals who did not perceive themselves as FI tended to use fewer coping strategies to manage their situation.
Hidden Hunger: Understanding the Complexity of Food Insecurity Among College Students [11]	Fortin et al., 2020	n = 30	University of Kansas Female: 63% Non-White: 53% FI: 100%	Mixed methods Cross-sectional	1. 6-item AFSSM 2. Nutritional habits/needs 3. Diet health impacts 4. Food access resource use	Personal/ Cognitive Factors Environment Behavior	Main themes that influence FS status identified: 1. FI students felt stigma toward food access resources/ worried about taking resources away from others 2. FI students had diminished diet quality 3. Students used coping strategies to improve food access	Students experienced stigma when using food access resources and feared they might be taking resources away from those in greater need. To cope with their FI, they adopted various strategies, often rationalizing these behaviors, as part of the typical college experience.
Examining The Role of Financial Factors, Resources and Skills in Predicting Food Security Status Among College Students [40]	Gaines et al., 2014	n = 557	University of Alabama, Tuscaloosa Female: 75.8% Non-White: 17.8% FI: 14%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Cooking Self Efficacy questionnaire 3. Resource Adequacy and Food Preparation Skills questionnaire	Behavior	1. ↑ Cooking self-efficacy = ↑ FS 2. ↑ Perceived food resource adequacy/skills = ↑ FS	Higher money expenditure and coping strategy scores were strong predictors of FI. Students employed a wide range of coping strategies. The most common strategies included: purchasing cheap/processed foods, stretching meals, and opting for less healthy options to make their food last longer.
“Spending All This Time Stressing and Worrying and Calculating”: Marginal Food Security and Student Life at a Diverse Urban University [41]	Gamba et al., 2021	n = 30	California State University, East Bay Female: 76.7% Non-White: 86.7% Marginally food insecure: 100%	Qualitative Cross-sectional	1. 10-item AFSSM	Personal/ Cognitive Factors Environment Behavior	Main themes identified: 1. Purchasing cheap/ inexpensive less healthy food 2. Self-perceptions of health	Students with marginal FI often employed coping strategies, such as purchasing inexpensive, unhealthy foods and regularly facing insufficient time to prepare and eat meals. Evidence shows that marginal FS should not be grouped alongside high FS, as these students experience distinct challenges.
Food Insecurity and Behavioral Characteristics for Academic Success in Young Adults Attending an Appalachian	Hagedorn and Olfert, 2018	n = 692	Appalachian State University Female: 71% Non-White: 12.7% FI: 36.6%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Money Expenditure Scale 3. Coping Strategy Scale	Behavior	1. ↑ Coping Strategy Scale score = ↑ risk of FI 2. ↑ Money Expenditure Scale score = ↑ risk of FI Covariates: Demographic, health and culinary variables	Findings indicate that behavioral differences, including coping strategies, spending habits, and academic progress, are linked to a student's FS status. These behaviors offer valuable insights into the

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
University [42]								challenges students face and the strategies they employ to manage them.
Expenditure, Coping, And Academic Behaviors Among Food-Insecure College Students At 10 Higher Education Institutes In The Appalachian and Southeastern Regions [21]	Hagedorn et al., 2019	n = 91,791	10 public Appalachian and Southeastern Universities Female: 69.7% Non-White: 25% FI: 30.6%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Coping Strategy Scale 3. Money Expenditure Scale 4. Cooking Frequency questions	Behavior	1. ↑ Money Expenditure Scale score = ↑ risk of FI 2. ↑ Coping Strategy Scale score = ↑ risk of FI Covariates: Gender, university, academic year, health, race/ethnicity, financial aid, BMI, Academic Performance Score, employment, marital status	Among students, individuals facing FI were more likely to spend large amounts of money, engage in coping behaviors, and experience lower academic performance.
Impact of Food Insecurity on Coping Strategies: A Comparison of High School and College Perceptions [43]	Halama et al., 2024	n = 231	University of Mississippi and Eastern Michigan University Female: 80.5% Non-White: 22.9% FI: 48%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Coping strategy use questions	Behavior	1. FI ↑ from high school to college 2. FI = ↑ Coping strategy use	There were notable differences in coping strategies employed by individuals with very low FS compared to those with low FS. Students who experienced lower FS during their high school and college years were significantly more likely to use coping strategies.
Cooking Facilities and Food Procurement Skills Reduce Food Insecurity Among College Students: A Pilot Study [44]	Halfacre et al., 2021	n = 338	University of Mississippi Female: 65.7% Non-White: 12.1% FI: 41.4%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Financial strain indicators 3. Resource Adequacy and Food Preparation Skills questionnaire	Behavior	1. Food procurement skills = ↓ FI within male students 2. Cooking facilities access = ↓ FI within female students Covariates: Race, living location, meal plan use, financial strain indicators (employment, loan borrowing, self-supporting)	Among males, food procurement skills were associated with reduced FI. For females, access to cooking facilities played a key role in reducing FI.
Food Security Characteristics Vary for Undergraduate and Graduate Students at a Midwest University [45]	Hiller et al., 2021	n = 675	Iowa State University Female: 66.4% Non-White: 20.9% FI: 32%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Food access resource use 3. Food procurement/environment questions	Environment Behavior	1. FI students = ↓ Time to prepare food 2. FI students = ↓ Time to shop 3. Graduate FI students = ↑ food access resource use 4. FI students = ↑ Likelihood of purchasing cheap food 5. Students were interested in learning meal preparation and budgeting skills Covariates: Gender, race, financial aid, residency, housing location	Students identified several barriers to food access. Undergraduate and graduate students facing FI were more likely to report frequently lacking the time to shop for or prepare meals. These students also employed various coping strategies, such as consistently purchasing the least expensive food options. This behavior was more common among students experiencing FI. Additionally, FI graduate students were more likely to rely on-campus food access programs than undergraduates.
Food Insecurity, MyPlate Recognition, And Meal Preparation Confidence	Kelly et al., 2024	n = 354	University of Alabama at Birmingham FI: 81.3%	Quantitative Cross-sectional	1. 6-item AFSSM 2. MyPlate knowledge	Personal/ Cognitive Factors Behavior	1. ↑ MyPlate knowledge = ↑ Meal preparation/cooking self-efficacy making healthy meals.	Familiarity in nutrition tools, like MyPlate, linked to greater meal-building confidence; although formal nutrition education was associated

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Among College Food Pantry Users [46]					3. Meal preparation/ cooking self-efficacy questions 3. Perceived resource adequacy questions		2. MyPlate knowledge influences pantry selections 3. No relationship between meal preparation/cooking self-efficacy and FS 4. No relationship between resource adequacy and FS	with improved meal preparation confidence. However, overall confidence in meal-building did not correlate with FS status.
Perceived Drivers of Food Insecurity and Coping Strategies of DACA-Eligible College Students—an Exploratory Study [47]	Klobodu et al., 2021	Survey: $n = 18$ Focus group: $n = 8$	California State University, Chico Survey: Female: 55.5% FI: 72.2% Focus group: Female: 50% FI: 62.5%	Multimethod Cross-sectional	1. 10-item AFSSM 2. Food procurement/ coping strategy use questions	Environment Behavior	Main themes identified associated with FS status: 1. Inadequate budgeting skills 2. Lack of skills for food preparation 3. Cultural differences and preferences 4. Skipping meals 5. Coping strategies	DACA students face unique challenges that increase their risk of FI. To manage these difficulties, they often rely on a variety of coping strategies to meet their basic needs.
Very Low Food Security Status is Related to Lower Cooking Self-Efficacy and Less Frequent Food Preparation Behaviors Among College Students [48]	Knol et al., 2019	$n = 368$	University of Alabama Female: 70.4% Non-White: 16.6% FI: 38.3%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Cooking Self Efficacy questionnaire 3. Food Preparation and Purchasing Behaviors Questionnaire 4. Food access resource use	Behavior	1. Students with very low FS = ↓ Cooking self-efficacy 2. Students with very low FS = ↓ Food preparation and purchasing behaviors Covariates: Food assistance, employment, financial independence, financial aid, economic shock, gender, race, ethnicity, and year in school	Individuals with FS had significantly higher cooking self-efficacy scores and engaged in more food preparation behaviors than those with very low FS, according to both unadjusted and adjusted analyses of FS status.
Social Support for Food Access and Budget Construction Predict Food Insecurity Among University Sophomores [25]	Lunan et al., 2024	$n = 222$	Appalachian State University, Boone Female: 75% Non-White: 15% FI: 46.4%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Budgeting knowledge test 3. Questions about social support for food access requested educational activities 4. Food access behaviors	Personal/ Cognitive Factors Behavior	1. FI students = ↑ need for social support (e.g., assistance with purchasing affordable, healthy foods, budgeting, meal planning) Covariates: Sociodemographic variables (age, race/ethnicity, employment, GPA, financial aid)	Students experiencing FI expressed a greater need for support in purchasing affordable healthy food, budgeting, meal planning, and creating grocery lists. Students often budgeted by purchasing store-brand items and purchasing food on sale.
The HOME Study: Understanding How College Students at a Hispanic Serving Institution Coped with Food Insecurity in a Pandemic [49]	Manboard et al., 2021	$n = 18$	Texas State University Female: 83% Non-White: 72% FI: 83%	Multimethod Cross-sectional	1. 6-item AFSSM 2. Food access resource use, barriers, and perceptions 3. Coping strategy use	Personal/ Cognitive Factors Environment Behaviors	Main themes identified associated with FS status: 1. Social support/sharing of resources 2. Access to food 3. Coping strategy use	Students highlighted 3 main themes affecting their FS: Social support from friends and family, which included sharing food, resources, and financial aid; barriers to accessing food, such as physical, economic, and systematic challenges; and coping strategies, including improving self-efficacy through learning to cook,

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/measures	Main indicators	Key findings	Summary and conclusions
Food Insecurity in California's Public University System: What are the Risk Factors? [50]	Martinez et al., 2017	<i>n</i> = 8705	University of California - 10 campuses Female: 67% Non-White: 66% FI: 40%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Access to food 3. Food sources 4. Barriers to food access 5. Use of and access to food access resources 6. Consequences of FI	Environment Behavior	1. FI = ↑ Coping strategy use compared to FS students 2. Interest in learning how to cook and budget 3. Limited information and confusion on how to use food access resources Covariates: Sex, age, race/ethnicity, socioeconomic factors (e.g., childhood history of FI, need-based financial aid), academic year, living situation, and barriers to food access	meal planning, and purchasing inexpensive groceries. Students facing FI were more likely to struggle with accessing affordable and adequate food, often opting for cheaper, less healthy options despite knowing the risks. They were also more likely to obtain food outside of traditional grocery stores.
Campus Food Pantry Use is Linked to Better Health Among Public University Students [51]	Martinez et al., 2022	<i>n</i> = 1855	10 campus University of California system Female: 78% Pell Grant Recipient: 47% First-generation: 55% FI: 60%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Depressive Symptom Scale 3. Self-perceived health 4. Food access resource/pantry use 5. Self-reported sleep sufficiency	Environment	1. Food access resource use = ↑ Perceived Health 2. Food access resource use = ↓ Depressive symptoms 3. Food access resource use = ↑ Sleep quality Covariates: Age, campus affiliation, sex, sexual orientation, racial/ethnic status, first-generation status, undergraduate/graduate, work-study receipt, federal Pell grant receipt, family income, houselessness, and time of first pantry visit	Use of the campus food pantry was directly associated with reduced depressive symptoms, improved perceived health, and better sleep.
Evaluation of a College-Level Nutrition Course with a Teaching Kitchen Lab [52]	Matias et al., 2021	<i>n</i> = 171	University of California, Berkeley Female: 62.6% Non-White: 88.9% Preintervention FI: 52%	Quantitative Pre-/postintervention	1. 6-item AFSSM 2. Attitudes and self-efficacy about food groups 3. Cooking Self-efficacy Scale 4. Cooking Attitudes Scale 5. Dietary intake questions	Behavior	1. Intervention => ↑ Attitudes and cooking self-efficacy scores for food groups and cooking 2. Intervention => ↑ self-reported F/V intake 3. Intervention => ↑ Frequency of cooking 4. Intervention => ↓ frequency of skipping meals	Interventions aimed at enhancing cooking skills and food group self-efficacy can lead to improved dietary-related behaviors and intake.
Integrated Nutrition and Culinary Education in Response to Food Insecurity in a Public University [53]	Matias et al., 2021	<i>n</i> = 171	University of California, Berkeley Female: 62.6% Non-White: 88.9% Preintervention FI: 52%	Quantitative Pre-/post-intervention	1. 6-item AFSSM 2. Perceived Stress Scale 3. Attitudes and self-efficacy about food groups	Behavior	1. Intervention => FI ↓ 2. Intervention => ↓ Stress 3. ↓ Stress = ↑ frequency of cooking, and ↓ frequency of skipping meals 4. ↑ F/V = ↓ FI	Interventions aimed at improving self-efficacy may help reduce FI and stress by teaching students critical cooking skills.

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
			Postintervention FI: 31%		4. Cooking Self-efficacy Scale 5. Cooking Attitudes Scale		5. ↑ Frequency of cooking, and ↓ Frequency of skipping meals = ↓ FI	
Freshmen at a University in Appalachia Experience a Higher Rate of Campus than Family Food Insecurity [54]	McArthur et al., 2018	n = 456	Appalachian State University: Female: 72.7% Non-White: 17.5% FI: 21.5%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Money Expenditure Scale 3. Coping Strategy Scale 4. Meal Skipping Scale 5. Food access/social support	Behavior	1. ↑ Coping Strategy Scale score = ↑ FI 2. No significant differences in Money Expenditure Scale scores by FS	Students from FI households have an increased likelihood of experiencing FI during their freshman year of college. Those who faced FI at home and on campus employed various coping strategies to manage their situation. The use of these strategies was correlated across both household and campus experiences with FI.
A High Prevalence of Food Insecurity Among University Students in Appalachia Reflects a Need for Educational Interventions and Policy Advocacy [55]	McArthur et al., 2018	n = 1093	Appalachian State University Female: 68.4% Non-White: 8.3% FI: 46.2%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Coping Strategy Scale 3. Money Expenditure Scale 4. Social Support Scale 5. Cooking frequency 6. Current food situation perceptions	Behavior	1. ↑ Money Expenditure Scale score = ↑ risk of FI 2. ↑ Coping Strategy Scale score = ↑ risk of FI	Higher money expenditure and coping strategy scores were strong predictors of FI. Students employed a wide range of coping strategies, with the most common being purchasing cheap or processed foods, stretching meals, and opting for less healthy options to make their food last longer
Use and Perceptions of a Campus Food Pantry Among Food Insecure College Students an Exploratory Study from Appalachia [56]	McArthur et al., 2020	n = 896	Appalachian State University Female: 70.2% Non-White: ~80% FI: 48.8%	Multi-method Cross-sectional	1. 10-item AFSSM 2. Perceived cooking skills 3. Frequency of cooking 3. Food access resource use/ awareness 4. Perceived benefits of pantry use 5. Pantry attributes rating Scale	Personal/ Cognitive Factors Environment Behaviors	1. 80% of pantry users were FI Main themes that influence Pantry use: 1. Stigma/barriers 2. Benefits of use 3. Perceptions of the food pantry	Individuals experiencing FI avoided accessing the pantry due to feeling that others needed it more, embarrassment about asking for help, believing they had adequate food access and uncertainty about how to seek assistance.
Persistent and Episodic Food Insecurity and Associated Coping Strategies Among College Students [23]	Mitchell et al., 2022	n = 888	University of Illinois - Urbana-Champaign Female: 53.8% Non-White: 52.7% First generation: 26.5% FI: 21.8%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Food acquisition/ management practice subscale	Behavior	1. Episodic/persistent FI = ↑ Coping strategy use compared to FS students 2. Differences in coping strategy use within students with episodic vs persistent FI 3. Persistent FI = ↑ frequency of coping strategy use. Covariate: Student classification, first-generation college student status, race/	The use of coping strategies varied significantly by FS status. Students experiencing episodic FI employed coping strategies more frequently than those who were FS, whereas those facing persistent FI relied on these strategies even more. The most common coping strategy across all FI students was purchasing inexpensive food. Notable differences in coping strategies were observed between FS and FI students. Both episodic and

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
The Role of Campus Food Pantries in the Food Security Safety Net: On-Going or Emergency Use at a Midwest Campus Pantry [57]	Mitchell et al., 2022	<i>n</i> = 888	University of Illinois at Urbana-Champaign Female: 39.8% Non-White: 52.7% First-generation: 26.5% FI: 21.8%	Quantitative Longitudinal	1. 10-item AFSSM 2. Food access resource satisfaction 3. Food access resource use, awareness and barriers	Personal/ Cognitive Factors Environment	ethnicity, and sources of financial support 1. ↑ Food assistance resource use among FI students vs FS students 2. Stigma/fears of taking away from others = ↓ Food assistance resource use 3. ↑ resource use among graduate students from year 1 to year 2	persistent FI were strong predictors of coping strategy use. The food pantry was often used for short-term support, with graduate and older students relying on it more frequently and for longer durations.
A Qualitative Analysis of Eating Behaviors Among Food Insecure College Students [58]	Mooney et al., 2023	<i>n</i> = 40	Twelve 4-y Illinois institutions Female: 70% Non-White: 30% First Generation: 58% FI: 100%	Qualitative Cross-sectional	1. 6-item AFSSM	Personal/ Cognitive Factors Environment Behaviors	Main themes identified: 1. Challenges of the college environment 2. Resource management – coping strategies and disordered eating patterns 3. Hiding hunger 4. Food access barriers and stigma	Students shared that adapting to college life was challenging, particularly when it came to prioritizing time for grocery shopping, meal preparation, and cooking. Many reflected on how their childhood experiences shaped their relationship with food and their ability to manage FI in college.
Low Food Security Present on College Campuses Despite High Nutrition Literacy [20]	Moore et al., 2020	<i>n</i> = 672	Texas Woman’s University (Houston, Dallas and Denton Campuses) Female: 88.4% White: 46.2% FI: 44.4%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Energy sources in food	Personal/ Cognitive Factors	1. Nutrition literacy was higher among individuals who were FS 2. Students with “poor” nutrition literacy were 2.07 times more likely to have low FS than students with “adequate” nutrition literacy Covariates: Gender, ethnicity, campus location, class status	Findings highlight a need for improved nutrition literacy as a means of addressing or potentially preventing FI among students.
Assessing Food Security Through Cooking and Food Literacy Among Students Enrolled in a Basic Food Science Lab at Appalachian State University [19]	Morgan et al., 2023	<i>n</i> = 39	Appalachian State University Female: 59% Non-White: 8%	Multi-method Pre-/post-intervention	1. 6-item AFSSM 2. Food literacy-based self-efficacy and behaviors	Personal/ Cognitive Factors Behavior	1. Basic needs course intervention => ↑ Food literacy-based skills, self-efficacy, and knowledge	Developing food literacy skills can significantly enhance food literacy-based self-efficacy by empowering individuals to make informed choices about nutrition, budgeting, and meal preparation.
SNAP Participation Decreases Food Insecurity Among California Public University Students: A Quasi-Experimental Study [59]	Nazmi et al., 2022	<i>n</i> = 79 (baseline)	California Polytechnic State University, San Luis Obispo Female: 50% Non-White: 73% FI (baseline): 83.8%	Quantitative Quasi-experimental longitudinal study	1. 6-item AFSSM 2. Perceived FS status 3. Food access resource use	Environment	1. CalFresh users = ↓ FI by 63% over 6 months 2. Rate of FI among CalFresh users (29%) vs. non-users (73.3%) at six-month follow-up Covariates: Survey timing, gender, race/ethnicity, years in and use of non-CalFresh food resources	CalFresh plays a crucial role in reducing FI among college students. For those enrolled in the program, FI significantly decreased from baseline to 6 months later.

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Struggling with the Basics: Food and Housing Insecurity Among College Students Across Twenty-Two Colleges and Universities [60]	Olfert et al., 2021	$n = 22,153$	22 Universities (NC, WV, LA, HI, VA, KS, IL, TN, AZ, AL, MS, UT, Northern Marina Islands) Female: 74% Non-White: 17.7% First generation: 23.3% FI: 44.1%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Money Expenditure Scale 3. Coping Strategy Scale 4. Food access resource use	Environment Behavior	1. FI = \uparrow Coping Strategy Scale scores compared to FS students 2. FI = \uparrow Money Expenditure scores compared to FS students 2. FI was associated with a greater awareness of on-campus food access resources Covariates: University, FI, housing insecurity	Students experiencing FI were more likely to use coping strategies compared to FS students.
Prevalence and Correlates of Food Insecurity Among Students Attending a Midsize Rural University in Oregon [61]	Patton-Lopez et al., 2014	$n = 354$	Western Oregon University Female: 72.9% FI: 58.8%	Quantitative Cross-sectional	1. 6-item AFSSM 2. Food assistance program use	Environment	1. \uparrow Food assistance resource use among FI vs. FS students. Covariates: Sociodemographic factors (age, income, gender, ethnicity), living arrangements, health insurance status, physical activity, enrollment status, etc.)	Students experiencing FI were more likely to use food assistance programs.
A Comparison of Experiences with Factors Related to Food Insecurity Between College Students Who Are Food Secure and Food Insecure: A Qualitative Study [62]	Richards et al., 2023	$n = 58$	Brigham Young University, Oregon State University and University of Hawaii-Manoa Female: 55.2% Non-White: 51.7% FI: 51.7%	Qualitative Cross-sectional	1. 6-item AFSSM 2. Hunger Vital Sign 2-item survey	Environment Behavior	1. FS and FI students face similar challenges and use similar methods of food purchasing 2. FS and FI students felt stigma toward food access resources	Both FI and FS students face challenges, such as financial strain from unexpected expenses, limited access to transportation, and difficulties obtaining food. Food-insecure students tend to prioritize rent over food, whereas FS students often prioritize entertainment. Both groups prioritize finding the cheapest food and view time as a significant barrier. Additionally, both feel stigma toward food assistance programs.
Food Insecurity Exists Among College Students at A Mid-sized University in Utah [63]	Savoie-Roskos et al., 2021	$n = 923$	Utah State University Female: 49.5% Non-White: 8.5% FI: 32.7%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Food access resource use 3. Diet quality 4. Barriers to food access	Environment	1. \uparrow Food assistance resource use among FI students vs FS students. 2. \uparrow Use of on-campus food pantry among FI students vs. FS students.	Students experiencing FI are more likely to engage in food assistance programs, utilize other support services, and access the on-campus food pantry than their FS peers.
Service, Scholarship, and Sacrifice: A Qualitative Analysis of Food Security Barriers and Strategies Among Military-Connected Students [64]	Schinkel et al., 2023	Quantitative: $n = 1328$ Qualitative: $n = 8$	University of Wyoming Military-connected students ($n = 127$) Female: 58.3%	Multi-method Cross-sectional	1. 6-item AFSSM 2. FS strategies	Personal/ Cognitive Factors Environment	Main themes that influence FS status identified: 1. Current and planned use of food access resources (access and offerings) 2. Barriers (pride and shame)	Veteran students voiced stigma around using food access resources. Most individuals shopped in the on-campus grocery store. Military-connected distance learners often found campus food resources

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Home-Prepared Meals Among College Students At-Risk for Food Insecurity: A Mixed-Methods Study [65]	Miller et al., 2023	n = 226	Non-White: 18.9% FI: 46% University of California, Davis Female: 83.2% Non-White: 28.3% FI: 30%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Meal preparation skills 3. Healthy diet motivation	Behavior	1 FI = ↓ meal preparation skills 2. FI = ↓ perceived ability on consuming a healthy diet Covariates: Year in school, race, ethnicity, and gender, ability and willingness to follow a healthy diet	inaccessible, and feelings of pride and shame served as barriers to use. Students experiencing FI demonstrated lower meal preparation skills and had less confidence in their ability to maintain a healthy diet. However, willingness to consume a healthy diet did not differ based on FS status.
Characteristics Associated with Cooking Frequency Among College Students [66]	Soldavini and Berner, 2021	n = 4845	University of North Carolina at Chapel Hill Female: 72% Non-White: 30.5% FI: 22.2%	Quantitative Cross-sectional	1. 10-item AFSSM 2. Cooking frequency questionnaire 3. Perceived cooking skills	Behavior	1. FI = ↑ odds of often or sometimes cooking Covariates: Race/ethnicity, year in school, living on vs. off-campus, having a car, receiving financial aid, perceived health rating, weight status, having a meal plan, FS status, and perceived cooking skills	Students experiencing FI were more likely to report cooking often or sometimes compared to FS students. Among them, those facing very low FS had the highest odds of cooking regularly.
College Students Identify University Support for Basic Needs and Life Skills as Key Ingredient in Addressing Food Insecurity on Campus [67]	Watson et al., 2017	n = 82	University of California, Los Angeles Female: 61% Non-White: 82% FI: 54%	Qualitative Cross-sectional	1. 6-item AFSSM	Personal/ Cognitive Factors Behavior	Main themes: 1. FS (awareness of FI, cost of attendance, consequences of FI, coping with FI) 2. Food Literacy (existing food knowledge and skills, enjoyment and social cohesion through food, learning in the dining halls)	Students experiencing FI reported opting for cheaper, less nutritious foods and frequently skipping meals as a means of coping. Food literacy skills, such as knowledge and training, were desired among students to improve their FS status and diet.
Obstacles to Food Security, Food Pantry Use, and Educational Success Among University Students: A Mixed Methods Approach [68]	Weaver et al., 2021	n = 1374	Rowan University FI: 52%	Mixed methods Cross-sectional	1. 10-item AFSSM	Personal/ Cognitive Factors Environment Behaviors	Main themes identified: 1. Obstacles to FS 2. Use of the campus food pantry 3. Managing needs (food and education)	Students experiencing very low FS were often hesitant to use on-campus food access resources due to concerns about stigma, embarrassment, and the belief that others might need the resources more than they do.
Understanding the Why of College Student Food Insecurity [9]	Zigmont et al., 2019	n = 19	Southern Connecticut State University Female: 68.4% Non-White: 63.2% FI: 89.5%	Qualitative Cross-sectional	1. 6-item AFSSM 2. Food access resource use	Environment Behaviors	Main themes that influence FS status identified: 1. Food preparation skills 2. Coping behaviors 3. Food access resources	Most students experiencing FI faced risk factors, including the inability to afford food, skipping meals, lack of transportation, limited time, and small portion sizes. However, several protective factors were identified, such as access to food resources, effective coping strategies, and time and money management skills.
Captive Market Pricing and Lack of Transportation: A	Zigmont et al., 2022	n = 951	Southern Connecticut State University	Quantitative Cross-Sectional	1. 6-item AFSSM 2. Diet quality	Environment Behaviors	1. FI students had different on-campus purchasing patterns	Individuals experiencing FI are less confident in their ability to cook and prepare meals. Additionally, FI

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TABLE 1 (continued)

Title	Author	Sample size	Participant characteristics	Design	Assessment tools/ measures	Main indicators	Key findings	Summary and conclusions
Survey of Undergraduate Food Insecurity at a Public University in New England [69]			Female: 63.1% Non-White: 40.4%		3. Food access resource questions and barriers 4. Food purchasing behavior questions 4. Nutrition environment measures survey		2. FI students were more likely to report barriers associated with healthy eating. Covariates: Gender, employment status, race/ethnicity, residential status, parent, member of a sports team, housing insecurity, and barriers to consuming a healthy and sufficient diet including price, time, transportation, access, and knowledge	students were more likely to face barriers associated with purchasing healthy foods. They were also more likely to rely on fast food and less likely to bring meals prepared at home.

Abbreviations: AFSSM, Adult Food Security Survey Module; FI, food insecurity/food insecure; FS, food security/food insecure; F/V, fruit(s) and vegetable(s); GPA, Grade Point Average.
¹Data presented pertains to Aim 2 of the study.

[46], energy sources of food [20], budgeting [25], and the influence of nutrition knowledge on dietary patterns [28,67], in addition to previously validated food literacy questionnaires [19,34]. Six studies focused on nutrition knowledge and food literacy, whereas 1 article focused on budgeting knowledge. All 6 studies on nutrition knowledge/food literacy studies highlight the potential of enhancing knowledge to significantly improve an individual's FS status. It was observed that students with greater nutrition knowledge or food literacy were more likely to be FS [28,34,46,67]. One study noted that students with lower nutrition literacy were 2.07 times more likely to experience low FS than individuals with greater nutrition literacy [20]. Additionally, nutrition knowledge was found to positively influence FS-related behaviors. Most of the included studies ($n = 5$) reported that students with greater nutrition, food literacy, or budgeting knowledge were more likely to demonstrate positive behavioral changes, such as making informed food purchases, having greater self-efficacy in nutrition-related decisions [19,25,28], improved budgeting practices [34], and enhanced meal preparation skills, among others [19,25,46]. Students with limited knowledge expressed a clear need for training and support in areas, such as nutrition education, meal planning, and financial management related to food procurement [25,67].

Attitudes

Fifteen studies examined the relationship between attitudes and FS. Of these, 2 studies used quantitative methods [39,57], 5 were qualitative [24,27,28,38,41], and 9 employed multi- or mixed-method designs [11,22,30,37,49,56,64,68]. The included studies were classified into 2 main categories: perceptions of FS and perceived need for food access resource(s).

Perceptions of FS

Five studies investigated students' perceptions of their FS, with 3 studies demonstrating that students often perceive themselves as more FS than they actually are [30,39,41]. Various methodologies were used across the 5 studies: 1 study used quantitative methods [39], 2 studies used a multi- or mixed-method design [11,30], and 2 studies employed a qualitative approach [27,41]. These varying methodologies allowed researchers to explore FS perceptions through a combination of self-reported data and structured interviews.

One study used a self-categorized FS questionnaire to evaluate the percentage of students classified as FI as well as the proportion of students who recognized their own FI [39]. Other studies investigated the differences between FS and students' lived experiences, in addition to the challenges associated with FI and related behaviors [30,41]. Data gathered from student interviews and free-response answers identified nuanced insights and experiences shaping FS status that may not be considered within the AFSSM classification [30,41]. Findings from these studies demonstrate that students experiencing FI may not perceive themselves to be FI, and that students tend to overestimate their FS, despite indications of resource insufficiency and anxiety surrounding food and acquisition [30,39]. This discrepancy between the AFSSM classification and perceived FS status was supported by self-assessments related to challenges with food access and resource adequacy [30,39,41]. One study asked students to

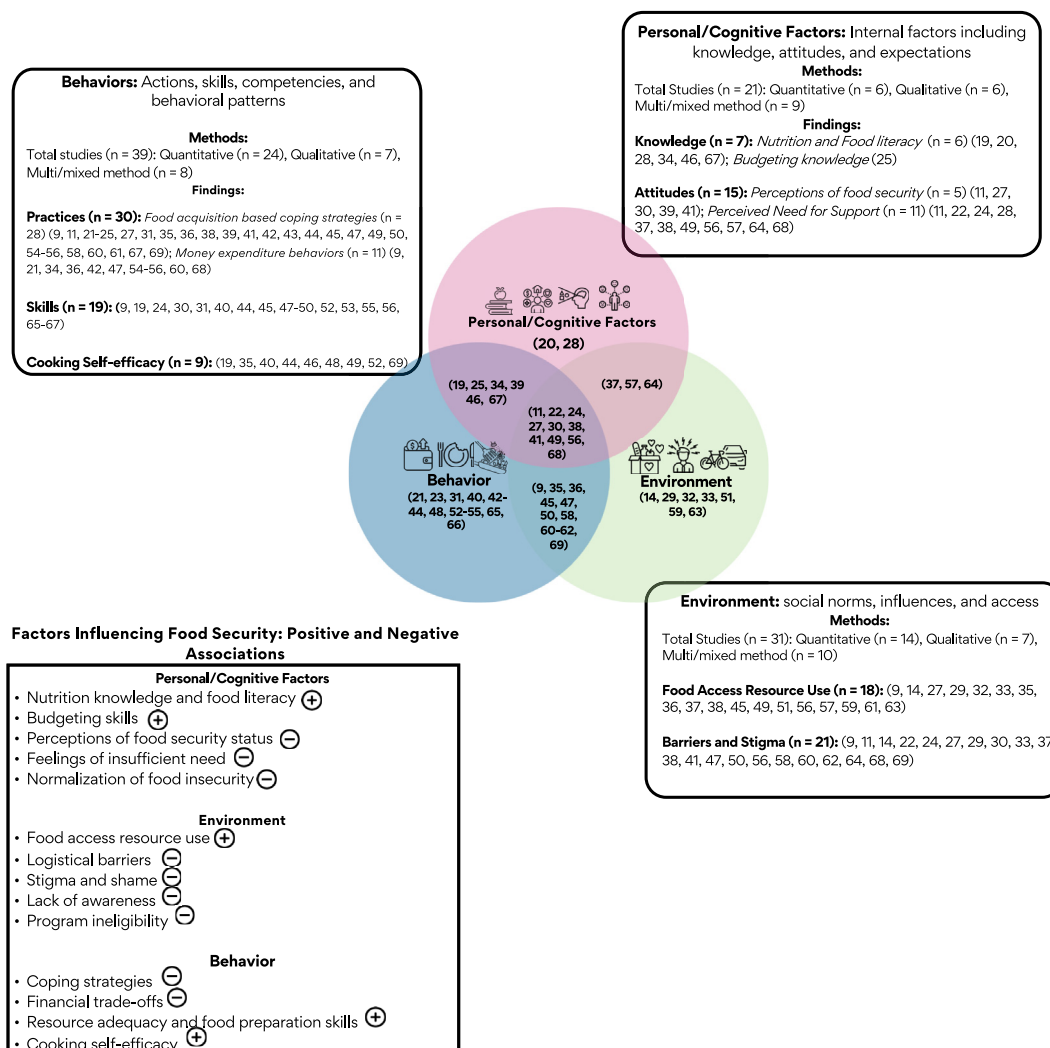


FIGURE 2. Factors influencing food security status through the Social Cognitive Theory framework.

define the term “food insecurity” as part of their interviews. Interestingly, responses reflected perceptions of FI as an inevitable barrier that comes with higher education [27], a finding echoed in another study that rationalized food-related behaviors [11].

Perceived need

The perceived need for food access resources was assessed in 11 studies that employed varying methodologies: 8 studies used multi- or mixed-methods [11,22,28,37,49,56,64,68], 2 studies were qualitative [24,38], and 1 study was quantitative [57]. Findings indicated that students often hesitated to use food access resources, largely due to the perception that others were in greater need [11,22,24, 28,37,38,56,57,64,68]. These feelings of insufficient need were identified as a significant barrier, thus limiting students’ use of support resources, such as on-campus pantries and basic needs centers. Consequently, students’ perceptions not only influenced the extent to which they utilized food access resources but also influenced their day-to-day livelihood and FS status [11,22,37,38,49,56,57,64,68]. In turn, 1 study noted that these perceptions of insufficient need led

students to feel like the food pantry was a last resort rather than a proactive means of assistance [38].

Environmental influences

Environmental influences on FS status were examined in 31 articles, with included studies addressing the role of food access and resource use among students. Across these studies, methodology varied: most studies (n = 14) used quantitative methods [14,29,32,33,35,45,50,51,57,59,60,61,63,69], 10 employed a multi-method design [11,22,30,36,37,47,49,56,64,68], and 7 used qualitative approaches, such as interviews and focus groups [9,24,27,38,41,58,62].

Food access resource usage

Eighteen studies examined the influence of food access resource use. Five of these studies focused on how these resources affected FS classification and overall food access [9,27, 38,49,59]. Within these studies, it was noted that food access resources served as an important facilitator of food access for students. Utilizing these resources, whether on-campus, within

the local community, or at the federal level, provided significant protective benefits that helped reduce FI among the student population [9,27,38,49,59]. A study examining the experiences of CalFresh users (California's equivalent of the Supplemental Nutrition Assistance Program [SNAP]) found that rates of FI among student participants decreased by 63% over 6 mo (78% vs. 29%) [59]. Similarly, the study noted that CalFresh users had 89% lower odds of experiencing FI compared with non-users, thus demonstrating the effectiveness of this program in reducing FI [59].

In addition to the observed impact of food access resource use on FS, 1 study explored the association between food pantry use, FS, and measures of sleep quality as well as mental and physical health [51]. These findings demonstrated that use of the campus food pantry was associated with improved perceived health status, suggesting improvements in students' well-being. Similarly, use of the campus food pantry was related to reduced depressive symptoms and improved sufficient sleep [51].

One study observed that use of the on-campus pantry was associated with increased consumption of fruits and vegetables among students who were FI [32]. Another study found that students who used the on-campus pantry experienced benefits such as having more money available for rent and utilities, increased fruit and vegetable intake, improved job and academic performance, and improved mental and physical health status [56].

Nine studies examined patterns of food resource utilization among students and found that those experiencing FI were generally more likely to access these resources [14,29,33,35,37,45,57,61,63]. Of these, 8 studies reported that students with FI used food access resources more frequently than their FS counterparts [14, 29, 32, 33, 36, 37, 61, 63], with 1 study noting that students with FI were 8 times more likely to use the food pantry [37]. Outside of FS status, 2 studies noted variability in food access resource usage between undergraduate and graduate students [45,57]. It was observed that graduate students accessed these resources more often than undergraduates and more frequently relied on these resources over longer durations [45,57]. Similarly, 1 study noted that international students, as well as those who received student loans or a Pell grant, were significantly more likely to use the on-campus food pantry [37].

Barriers and stigma

Twenty-one studies highlighted barriers and stigma associated with food acquisition and food access resources. Barriers, such as limited time, transportation, and cost of food, significantly influenced students' ability to obtain and purchase food [9,41,50,68,69]. One study found that students who were FI often lacked the time to shop for groceries, which influenced their dietary habits. As a result, they relied more on nonperishable food items, ate out more frequently, and/or postponed grocery shopping [62]. Similarly, students found cooking "healthy" meals time consuming and discussed that they often turned to fast food due to the lack of time for meal planning and preparation [68]. Financial constraints affected the quantity and quality of a student's diet [9,41,50,68,69]. Several studies highlighted challenges related to pay schedules or benefit disbursement periods, which created a cyclical pattern of FI, thus leading to fluctuations in a students' FS status [62].

Regarding food access resource use, 1 common theme across studies was persistent feelings of stigma [11,27,29,37,38,58,62,64,68], shame [22,58,64], and embarrassment [37,56,58,68], which significantly deterred students from using food assistance programs. In several studies, students discussed that they believed they should be self-sufficient and not have to rely on food assistance programs or support to manage [22,38,62]. These internalized barriers often prevented students from using resources, even in times of dire need.

In addition to stigma-related factors, 5 studies investigated practical barriers and challenges associated with using food access resources [30,37,38,56,64]. Accessibility issues were among the most frequently noted challenges, such as limited or conflicting hours of operation, long wait times, inaccessible or inconvenient locations, and lack of transportation [24,29,30,37,38,58,64]. Among those using on-campus pantry resources, students expressed that they were dissatisfied with the options available to them, noting that food was often perceived as "not healthy," "nutritious," or past its "best by" date [38,64].

Another common issue was lack of awareness about the food pantry, including confusion about eligibility criteria and the process for accessing assistance [11,14,27,37,38,50,56]. One study reported that nearly half of the students surveyed were unaware of on-campus pantry services, and almost 90% had never used this resource [29]. Research conducted at the University of Florida highlighted similar concerns, with students unsure about their eligibility for campus food access resources, including the on-campus food pantry [37]. Another study emphasized the importance of marketing on-campus food access resources, noting that students who were aware of these resources were 23% less likely to experience FI [60].

Similar barriers were documented for participating in federal food assistance programs. A study on SNAP participation found that many students are unaware of their eligibility, and therefore missed out on the program's benefits [33]. Focus groups in 1 study found that 70% of students reported that they had never considered applying for SNAP benefits [11]. Furthermore, a lack of clarity around the application process and eligibility requirements discouraged students from seeking assistance [33,58]. Further, ineligibility posed a significant barrier for Deferred Action for Childhood Arrivals (DACA) students [47] and international students [62].

Behavior

Thirty-nine articles examined the relationship between FS and behavior. Of these, most ($n = 24$) employed quantitative methods, 7 used qualitative methods, and 8 utilized a multi or mixed-methods design. The studies investigating behavior focused on 3 main areas: practices, skills, and cooking self-efficacy.

Practices

The majority of included studies ($n = 28$) focused on the use of food acquisition strategies, commonly referred to as "coping strategies," to obtain food or related resources [9,11,21–23,25,27,31,35,36,39,42,43,45,47,49,50,54,55,58,60,67,69]. Measurement of coping strategies use varied across studies; 9 of the quantitative studies used validated coping strategy scales [22,24,25,36,38,65,47,54,62,58], whereas other studies relied on author-generated items [31,42,61]. In the qualitative and

multi- or mixed-method studies, students were typically asked about their methods for obtaining food or coping with FI, most often through interviews [9,22,36,49,58].

Notably, 83% of the included studies reported that coping strategies use was more prevalent among students experiencing FI [9,11,21–23,31,35,36,39,42,43,45,47,49,50,54,55,60,69]. Conversely, 4 studies highlighted that coping strategies positively influenced FS status [9,24,27,49]. Additionally, 1 study found that some individuals adopted coping strategies because they believed that FI is a private matter, and they should not rely on others for assistance [22]. Among the various coping strategies, the most reported coping strategy among students was purchasing inexpensive, ultraprocessed, and/or unhealthy foods [22,23,35,41,45,47,49,50,55,58,67,69]. Additionally, students frequently coped by reducing food intake, either by eating less or skipping meals [9,31,36,55,67]. One study noted that 1 in 4 students had to make difficult financial trade-offs, such as having to choose between purchasing food, saving money by skipping meals, or eating less nutritious options [36]. Another study found that students avoided purchasing perishable items, like fresh fruits or vegetables, due to concerns about spoilage [58]. Although these strategies may reduce or prevent immediate hunger and preserve meal quantity, they often diminish nutritional quality and can potentially contribute to disordered eating behaviors [22,36,47,58,67].

Several studies highlighted distinct differences in the type and frequency of coping strategy used by individuals. One study identified variations between students experiencing persistent versus episodic FI, finding that those facing persistent FI relied on coping strategies more frequently than those with episodic FI [23]. Another study noted that students who used coping strategies were 1.19 times more likely to be FI [21]. Differences also emerged in the specific coping strategies employed based on FS status, such as individuals experiencing FI most commonly avoided purchasing expensive foods, whereas individuals classified as FS attended free events for food [23]. One study found that although grocery stores were the most common place to obtain food, FI students were more likely to also seek out food through alternative sources, such as family and friends' homes, free events, and food pantries [67]. Additionally, another study reported that students who were FI shopped for groceries less frequently than their FS counterparts and were more likely to take advantage of free food options available to them [36]. One study provided a deeper analysis on students with marginal FS. According to the USDA AFSSM, "high" and "marginal" FS are typically grouped into a FS category when FS is used as a binomial variable. However, findings from this study suggested that individuals with marginal FS should not be classified as FS, as their coping behaviors more closely resemble those of individuals who are FI [41].

Differences in coping strategy use were also reported based on students' perceptions of their FS status [23]. Among students classified as FI, those who did not perceive themselves to be FI tended to use fewer coping strategies than those who agreed with their classification [39]. Additionally, college students experiencing FI were significantly more likely to use food-related coping strategies if they also experienced FI during high school [43]. Among individuals with FI, coping strategy scale scores were also higher among upper-year students (juniors and seniors) and those living off-campus [55].

A subset of studies ($n = 11$) examined money expenditure and related financial behaviors [9,21,34,36,42,47,54,55,62,60,68]. These studies employed a range of methods and measures to assess spending behaviors, with the most common being the validated Money Expenditure Scale (MES), which asks students to estimate how often they spend money on non-food items rather than food [21,54,55,60]. One study used a ranking system to evaluate financial prioritization, assessing expenditures on various items, such as clothing, tuition, alcohol, and food [34]. Additionally, 4 studies used qualitative methods to capture financial challenges, experiences, and nuanced decision making related to spending behaviors [9,47,62,68].

Across all 11 studies, higher MES and/or financial prioritization of non-food items were associated with increased FI. Several studies reported that students with higher MES scores were significantly more likely to experience FI than those with lower scores [21,42,54,55]. One study noted that over 20% of students reported having to choose between spending money on food or covering other expenses related to living or attending college [36]. This challenge was often exacerbated by unexpected expenses that often led students to cut down on food-related purchases [62].

The most commonly prioritized non-food items were school-related fees, housing costs, entertainment, make-up, and fashion [47,54,68]. One study also found that students who prioritized alcohol or drugs over food had a higher likelihood of experiencing FI [34]. Additionally, more than half of the study participants prioritized tuition costs over food purchases, and these students were more likely to be FI [34]. Another study reported that 66% of participants prioritized housing costs over food [47]. Qualitative findings further emphasized that financial obligations, such as bills, health care, transportation costs, and gas, often prevented students from purchasing or prioritizing food [9,36,62]. This challenge was particularly relevant for commuter students, who face higher transportation expenses [9].

Skills

Nineteen studies examined the relationship between food-related skills and FS status, which included challenges and potential avenues for support [9,19,24,30,31,40,65,45,47–50,52,53,55,56,44,66,67]. Of these, 11 studies used quantitative methods, 5 employed a multi- or mixed-methods design, and 3 studies used qualitative methods. Measurement tools varied across studies, which included food preparation skill questionnaires [31, 65] and the Perceived Food Resource and Skill Adequacy Questionnaire [40,70].

First-year students commonly attributed FI to limited or a lack of food preparation and cooking skills [30]. Research indicates that students experiencing FI reported lower perceived food resource adequacy and skills than their food-secure counterparts, with higher resource adequacy scores associated with improved FS status [40]. However, contrary to these findings, several studies found no significant differences in perceived cooking skills based on FS status [31]. Food-related skills emerged as a strong predictor of cooking frequency, with 2 studies finding that individuals experiencing FI reported cooking more frequently than their FS counterparts [55,66]. Other studies highlighted practical life skills, such as budgeting and purchasing strategies, as key determinants of FS status [9,24,49]. Students expressed that enhancing their skills in meal preparation and budgeting

could help them maintain or improve their FS [25,30,65,45,50,55,67]. Notably, 1 study found that students viewed college as an opportunity to develop these practical skills and expressed interest in courses or training to strengthen these competencies [67].

Intervention-based studies demonstrated the positive impact of skill-building programs and interventions on FS and related behaviors. A hands-on, integrated nutrition and culinary intervention spanning an academic semester (14 wk) led to increased cooking frequency, decreased meal skipping, and a reduction in perceived stress and FI [53]. Furthermore, after completing the course, students reported an increase in fruit and vegetable consumption, which was linked to improved FS [53]. Similarly, a skill-building food literacy intervention found that combining nutrition knowledge with hands-on training effectively improved student's basic cooking skills [19]. Beyond the direct link between skills and FS, limited food preparation skills were also found to deter students who were FI from using campus food pantries [56]. Additionally, a study focusing on DACA students highlighted that cultural differences in food preferences and cooking methods often made it challenging for these students to prepare nutritious meals using the ingredients available to them at food pantries [47].

Cooking self-efficacy

Nine studies investigated the relationship between cooking self-efficacy and FS [19,35,40,65,46,48,49,52,69]. Five studies used quantitative methods, including 2 intervention-based studies [19,52], whereas 2 employed a multi- or mixed-methods design [49,52] and 1 study used qualitative methods [69]. Various tools were used to assess cooking confidence, including the Cooking Self-Efficacy Questionnaire developed by Clifford et al. [40,48,71].

Several studies identified that higher cooking self-efficacy was associated with improved FS [35,40,65,48,69]. Another study indicated that although students who were FI were willing to follow a healthy diet, they perceived themselves as having a lower ability to do so [65]. However, 1 study found no significant relationship between overall confidence in meal building and FS status [46].

Intervention-based research suggested that skill-building programs could be effective in enhancing cooking self-efficacy. One intervention aimed at improving culinary skills was associated with improved self-efficacy surrounding cooking, diet quality/choice, and consumption of fruits and vegetables [52]. Similarly, students participating in a food literacy intervention reported feeling more confident in their ability to cook using various methods and ingredients, prepare balanced meals, and plan meals effectively [19].

Limitations

This scoping review highlights several key limitations in the current body of literature on FS and related factors among college students. First, FS research utilizes a wide variety of measures and methods to quantify or classify individuals' FS classification, which complicates cross-study comparisons and rate estimates. In addition, use of tools other than the USDA AFSSM resulted in the exclusion of potentially relevant studies within this review, as

several were excluded during the title and abstract review phase and 9 were excluded at the full-text review phase. To mitigate the potential differences and challenges that could arise from measurement variability, the present review only included studies that used one of the variations of the USDA AFSSM tool; most studies employed either the 10-item or 6-item module. However, key differences exist between the 2 variations, including the questions asked, classification groups, and scoring rubric, which may result in different classifications for the same individual [7,72]. Although the 10-item tool offers a more thorough assessment by classifying individuals into "low" or "very low" FS groups, the 6-item version has a more limited scope where individuals are commonly reported as "food secure" versus "food insecure" [73].

Furthermore, concerns persist about the applicability and accuracy of the USDA AFSSM within the college student population [7]. Although the USDA AFSSM is currently considered the preferred measurement tool for FS, it has not been specifically validated for use in college populations [7]. Research suggests that college students tend to interpret questions differently than expected or intended, and, in turn, their FS status may be incorrectly classified [74]. Research has produced mixed findings: as highlighted in this review, several studies have demonstrated that students often perceive themselves to be more FS than they are, which can affect the way they answer FS-related questions leading to misclassification [30,39]. In contrast, work by Nikolaus et al. [7] indicated that the USDA tool may incorrectly classify or even overestimate FI depending on the version of the tool used [7]. Furthermore, issues arise from college students misinterpreting key terms within the AFSSM, such as "money for more," "real hunger," and "balanced meal," and struggling to estimate their experiences over the past 30 d [74]. Additionally, although the USDA tool primarily focuses on financial inadequacies and anxieties, it does not fully encompass the range of challenges that affect FS in college populations. These findings underscore that the current survey methods may not be fully appropriate for use within this population.

Another limitation is that FS and its related factors were often measured at a single point in time. This cross-sectional approach does not capture the well-documented temporality of FS where an individual may be FS 1 wk and face FI the next [23,75]. Additionally, the time frame across included studies varied widely. Students were often asked to recall experiences spanning from 1 mo to several months or even an entire academic term. Yet, these findings are usually compared against the standardized 30-d reference period used for FS assessments. This inconsistency further complicates efforts to develop a cohesive understanding of the factors influencing a student's FS.

In summary, this scoping review uses the SCT as a framework to investigate factors associated with college student's FS status. Findings from the review provide valuable insights into the factors related to FS, effective interventions, and potential solutions specific for college students. Collectively, personal/cognitive factors, behaviors, and environmental influences were found to have a significant association with FS among college students. In addition, longitudinal studies provided greater insight into the temporality of FS and should be considered for future research efforts. Addressing these gaps is essential for developing evidence-based strategies that can effectively mitigate FI across diverse populations.

Implications and Future Directions

The heightened rates of FI among college students remain a pressing issue. As research continues to examine the contributors, mitigators, and consequences of FI, the need for effective, comprehensive interventions becomes increasingly critical. This review explored the role of individual factors, behaviors, and environmental influences in relation to FS status. However, there are significant gaps that persist in the literature that should be addressed. Although an extensive body of work investigates the determinants of FS, most studies focus on 1 component of reciprocal determinism within the SCT. As demonstrated within this review, only 10 of the 53 included articles incorporated all 3 elements of reciprocal determinism (personal/cognitive factors, behaviors, and environment). However, even within these studies, not all components of reciprocal determinism were examined in detail. In turn, several elements of the SCT that focus on evaluating behavioral change, such as self-efficacy, reinforcement, and outcome expectations, remain underexplored. Although reciprocal determinism offers a strong foundation for understanding factors that shape FS, future research is recommended to examine all components within the SCT collectively. This will enable research to capture interactions and combined effects on behavior change, in addition to identifying possible strategies to improve rates of FS across college campuses.

Similarly, although there is substantial evidence exploring the association between SCT factors and FS, there is limited research employing interventions or programs to track how these factors change over time. Furthermore, although several studies included within the review focused on investigating the effectiveness of an intervention, these primarily assessed short-term changes from pre-intervention to post-intervention, which typically span only a few weeks or over an academic term. To gain a deeper understanding of the evolving nature of FI and the sustainability of interventions, future research should prioritize longitudinal studies that follow an individual's FS status throughout their academic journey. Intervention-based longitudinal studies that evaluate the effectiveness of targeted interventions can provide valuable insights into the dynamic nature of FI and inform strategies for long-term, sustainable solutions. Addressing these gaps will not only advance theoretical understanding but also inform the development of targeted, evidence-based interventions to effectively support FI college students.

Author contributions

The authors' contributions were as follows – ES, DSF, RES: developed the review concept and prepared the initial drafts of the manuscript, tables, and figures; ES, RES: performed the literature search; and all authors: provided valuable feedback, and reviewed and approved the final manuscript.

Conflict of interest

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