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The Relationship Between a Campus Food Pantry and Academic Success at a Public University

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Abstract: Food insecurity (FI) is associated with lower academic performance in university students. This research aimed to describe the relationship between a campus food pantry and academic performance, describe the characteristics of student pantry shoppers (PSs), and develop a model to predict academic success. Researchers obtained student pantry swipes and university data (2021–2022 academic year) to generate a dataset for grade point average (GPA) (N = 23,896) and a subset of PS sociodemographic data (N = 852). Variables (cumulative or term GPA) differed based on models. Explanatory variables were biological sex, age, frequency of pantry shopping, classification, Pell Grant eligibility, college, athlete status, citizenship, residency, ethnicity/race, honors, and first-generation status. The analysis included the two-sample *t*-test, logistic and multiple regression, and the least absolute shrinkage and selection operator (LASSO). There was no difference (t(921.8) = 0.518, $p = 0.60$) in the cumulative GPA between PSs (M = 3.001 [0.808]) and non-pantry shoppers (NPSs) (M = 3.016 [0.874]). In the fall term, PSs (M = 3.018 [1.012] earned a higher GPA (t(581.69) = −2.235, $p = 0.03$) than NPSs (M = 2.919 [1.123]). Pantry shoppers achieved academic success despite exhibiting risk factors for FI, including first-generation status, being of the female sex, and financial need. Targeted multicomponent campus programs are needed to provide food assistance to students at risk for FI.

Keywords: food insecurity; academic success; campus food pantry; COVID-19 pandemic

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1. Introduction

In the last decade, the number of campus food pantries has increased to improve healthy food availability and to combat growing rates of food insecurity (FI) in university students (Broton et al. 2022). Food insecurity is defined by the United States Department of Agriculture (USDA) as a "household-level economic and social condition of limited and uncertain access to food" (USDA Economic Research Service 2023). It is associated with physical and mental health conditions, as well as lower academic performance, which may delay or prevent students from graduating from college and launching a career (Martinez et al. 2020). The impacts of FI are of particular concern in Texas, where the state household FI prevalence averaged 16.9% (2021–2023) compared to the US average of 12.2%, ranking Texas as the second highest for FI behind Arkansas (USDA 2023). This research aims to examine the relationship between shopping in a campus food pantry and the academic performance of university students.

1.1. Food Insecurity Among College Students

Before the COVID-19 pandemic, the prevalence of FI was estimated to be forty-one percent (Nikolaus et al. 2020) in US students attending community colleges and 4-year universities, and students still report elevated post-pandemic eating concerns (Center for Collegiate Mental Health 2024). One reason for the high prevalence of FI at universities is

that nearly half of college freshmen who experienced household FI in high school continue to experience FI during college (McArthur et al. 2018). Additional factors are implicated, such as the cost of tuition, housing, and books, which increase financial demands on the student and reduce monetary resources for basic needs such as food.

At universities, students who live off-campus and do not purchase a meal plan are more likely to experience FI (El Zein et al. 2019; Hiller et al. 2021; Idehai et al. 2024). Students at the highest risk for FI include women (Miles et al. 2017; Weaver et al. 2020), freshmen (Bruening et al. 2016; McArthur et al. 2018), first-generation students (Camelo and Elliott 2019; Crutchfield et al. 2020; El Zein et al. 2019; Miles et al. 2017; Olfert et al. 2021), students who receive financial aid (Camelo and Elliott 2019; Crutchfield et al. 2020; El Zein et al. 2019; Hiller et al. 2021; Payne-Sturges et al. 2018; Weaver et al. 2020), international students (Soldavini et al. 2022), and Black (Camelo and Elliott 2019; Hiller et al. 2021; Miles et al. 2017; Payne-Sturges et al. 2018; Weaver et al. 2020) and Hispanic (Camelo and Elliott 2019; Hiller et al. 2021; Weaver et al. 2020) students. College students may lack financial resources, knowledge of shopping and food preparation, transportation, and cooking equipment while encountering barriers, including high prices, which reduce access to healthy foods, especially in rural environments (Bardenhagen et al. 2017; Hiller et al. 2021; Idehai et al. 2024; Payne-Sturges et al. 2018; Sanders et al. 2023; Zigmont et al. 2023). Many college students report there is little time to plan, shop, and prepare healthy meals (Reed et al. 2016). Barriers to purchasing and preparing nutritious food may lead to higher rates of FI among college students, resulting in deficiencies of essential nutrients to maintain health (Shi et al. 2022).

Food insecurity is associated with shopping at convenience stores that stock less expensive foods (Hiller et al. 2021), including energy-dense, nutrient-poor (EDNP) and ultra-processed foods (Leung et al. 2022; Ma et al. 2017). Eating a diet high in EDNP and ultra-processed foods may lead to excess consumption of calories, fat, sodium, and sugar, as well as vitamin and mineral deficiencies due to a low intake of fruit, vegetables, dairy products, and foods containing whole grains. Adults with low food security who consume a highly processed diet are at higher risk for obesity and cardiometabolic diseases (Radtke et al. 2024), including diabetes, nonalcoholic liver disease, and coronary heart disease (Golovaty et al. 2020; Li and Rosenthal 2021; Liu et al. 2024).

Food insecurity is also associated with more symptoms of depression and anxiety (Coakley et al. 2022; Coffino et al. 2021). Research indicates that college students with FI report symptoms of depression and anxiety more frequently than their food-secure peers (Bruening et al. 2016; El Zein et al. 2019; Manboard et al. 2021). Although the science of nutrients and their precise impact on depression and anxiety requires more investigation, findings show that nutritional substrates must be present to produce neurotransmitters, i.e., serotonin. Serotonin levels are often lower in people who have depression (Saha et al. 2023).

The COVID-19 pandemic exacerbated food insecurity and mental health challenges among college students (Hayden et al. 2023), with one-third of college students experiencing depression (The Hope Center for College, Community, and Justice 2021) and more reports of depression impacting academic performance (American College Health Association 2021). Upon returning to in-person classes in 2021, students with basic need insecurities, such as low food availability, experienced higher levels of anxiety and depression (Coakley et al. 2022; Jones et al. 2021). Food insecurity is intricately linked to adverse mental health outcomes, which may decrease academic performance (Raskind et al. 2019).

In addition to physical and mental health impacts, FI harms the academic performance of US college and university students. This is well documented with reports of food-insecure students earning lower GPAs than food-secure students (Beam and Johnson 2023; Cedric et al. 2023; Hickey et al. 2019; Woerden et al. 2019; Zigmont et al. 2020). The inverse association between FI and GPA (Camelo and Elliott 2019; Hagedorn and Olfert 2018; Hagedorn et al. 2019; Haskett et al. 2021; O'Neill and Maguire 2017; Olfert et al. 2021; Simon et al. 2018; Weaver et al. 2020) increases the likelihood of failing, withdrawing, or taking an incomplete grade (Beam and Johnson 2023) and lowers the odds of college

graduation or obtaining a bachelor's degree, particularly for first-generation students (Wolfson et al. 2022).

1.2. Maslow's Hierarchy of Needs Theory

Although most campus food pantries are not designed to fully meet students' dietary needs, they provide food during times of increased financial need and hardship, i.e., post-COVID-19. Consequently, researchers conceptualized this study based on Maslow's hierarchy of needs (Maslow 1943) and through a socioecological lens. Maslow's theory describes the drive to satisfy basic physiological needs, which may foster the achievement of higher goals, i.e., academic success. This theory reflects the students' determination to resolve personal hardships during college, including the health, economic, educational, and societal impacts of the COVID-19 pandemic to attain academic success.

1.3. College Food Pantries

Food pantry shoppers (PSs) often consume a diet low in recommended nutrients for health. In fact, many PSs eat a lower-quality diet than most US adults (Eicher-Miller 2020), with nutrient deficits due to a lack of fruit, vegetable, and dairy food groups (Simmet et al. 2017). While FI prevalence is higher among PSs compared to the US population, community pantries effectively address this issue by providing essential food items to those in need. By offering a variety of nutritious foods and beverages, food pantries contribute to improving the overall diet quality and nutrient intake of individuals and families experiencing FI. This underscores the importance of supporting and expanding the reach of community pantries to ensure better access to healthy foods for all (Matthew et al. 2023). However, the stigma of asking for food assistance is a frequently cited barrier to shopping in food pantries (Jones et al. 2024; Peterson et al. 2022). Providing food assistance to students at risk for FI rather than those who are identified as having FI is suggested to reduce the stigma associated with seeking food assistance on campus (Goldrick-Rab et al. 2020).

Forty-five percent of current US college and university food pantries opened between 2016 and 2021 (Scheitzer et al. 2022), resulting in better food access, improved food availability, and more resources to fight hunger. To assist students with FI, Swipe Out Hunger crafted The Hunger Free Campus Bill (Swipe Out Hunger 2024). This legislation passed in ten states and it has been introduced in ten additional states, providing funds to public universities that are addressing student hunger on campuses. As a result, campus food pantries have worked to decrease FI and the risk of becoming food-insecure through interventions that improved food access and availability (Broton et al. 2022; Freudenberg et al. 2019; Hollis-Hansen et al. 2023; Pradhananga et al. 2023; Shaabneh et al. 2023), enhanced fruit and vegetable intake (Alexis et al. 2022; Chodur et al. 2023), and addressed mental and physical health along with lifestyle habits, such as sleep (Martinez et al. 2022).

The campus food pantry in this study opened in 2014 on the main campus of a rural Texas public university to improve access to healthy food and its availability to students who were at risk for FI (USDA Economic Research Service 2024). In Texas, FI is a problem for one-third of college students (Owens et al. 2020; Umeda et al. 2020), and the prevalence of FI continues to rise post-COVID-19. A recent survey at our university (N = 283 students) showed that 60% of students were classified as having low or very low food security (Fletcher and Cornett 2024). In addition to more female students with FI (Moore et al. 2020), freshmen, first-generation students, financial aid recipients, and international, Black, and Hispanic students are frequently classified as food-insecure, as previously discussed. Pantry shoppers are likely food-insecure; however, obtaining food from a pantry is an intervention that may attenuate hunger and FI, and thus potentially improve academic performance in addition to promoting improvements in healthy food intake and nutrition status. This study aimed to investigate if students at risk for FI were shopping in the campus food pantry and if additional promotion of the pantry to high-risk groups was needed. Therefore, we selected variables to identify students using sociodemographic characteristics associated with an elevated risk for FI, and GPA (term and cumulative) was used to measure academic

performance. This study fills a gap in the research about participation of students at a high risk for FI in the pantry and the pantry shoppers' academic performance (Broton and Cady 2020; Goldrick-Rab et al. 2020).

1.4. Research Objectives

Given the associations of FI with detriments to physical and mental health, lower levels of academic success, and reduced graduation rates, it is important to study effective campus interventions to reduce the risk of FI. This research aims to describe the relationship between a campus food pantry and academic performance, describe characteristics of student pantry shoppers, and develop a model to predict academic success. Researchers developed the following research questions for the project:

1. Describe the academic and sociodemographic characteristics of students who shop at the campus food pantry.
2. Is there a difference between the 2021–2022 cumulative GPA for PSs compared to non-pantry shoppers (NPSs)?
3. Is there a difference in the 2021–2022 spring, summer, and fall term GPA for PSs compared to NPSs?
4. What is the best model to predict academic success in PSs?

2. Materials and Methods

2.1. Study Design

Researchers employed a cross-sectional study design to analyze the GPA dataset. The student population differed each semester by enrollment; thus, observations were not studied over time. Observations in the GPA dataset (N = 23,896) included students enrolled in the university in the 2021–2022 academic year. Researchers divided the observations in the dataset into two groups based on whether they had shopped in the campus food pantry or not during 2021–2022 (PS, n = 849; NPS, n = 23,047). Models for academic success were developed using the pantry data subset. Participants in the pantry data subset (N = 852) included students enrolled in the university in the 2021–2022 academic year who shopped in the pantry. The research protocol received expedited approval from the university's Institutional Review Board. Also, the Office of Research and Sponsored Programs granted permission and approval for researchers to use previously collected university data in this research.

Researchers selected the variables for this study based on findings from investigations of sociodemographic factors related to FI in postsecondary students (El Zein et al. 2019; Weaver et al. 2020; Woerden et al. 2019). As discussed earlier in this paper, race/ethnicity (Black and Hispanic), biological sex (female), student classification (freshman), first-generation status, and students who receive financial aid (Pell Grant eligible) are risk factors for FI in college students. Researchers selected GPA as an indicator of students' academic success. To add to the limited information about the pantry, researchers investigated variables to predict academic success.

Researchers generated two de-identified datasets in Microsoft Excel (version 2402, Microsoft, Redmond, WA, USA) using secondary data including sociodemographic information, term and cumulative institution GPA, and campus pantry swipe data. Students implied consent to participate in the research by swiping a university ID card in the food pantry primarily on bimonthly distribution days in the 2021–2022 academic year. The main dataset (GPA data) originated at the university and included undergraduate and graduate students enrolled in the 2021–2022 academic year by academic term, cumulative GPA, and term GPA. Researchers added pantry shopping (binary) as determined by student swipes of a university identification card upon entry to the pantry.

A data subset (pantry data) originated with student swipes of a university identification card at the campus food pantry. Researchers merged the pantry swipe data with previously provided student information and university data including biological sex, age, race/ethnicity, citizenship, residency, first-generation status, student level, classification,

student type, academic standing, time status, athlete status, college, major, veteran status, sport type, Pell Grant eligibility, and honors status. To generate the pantry shopping frequency variable, each new date and time of a pantry swipe was coded as one entry into the pantry unless it occurred within one hour of another swipe, which rarely occurred and was viewed as a duplicate swipe. The GPA and the pantry datasets were sortable by semester term (fall, spring, and summer) and academic year. All identifiers were removed to create a dataset for analysis.

2.2. Statistical Analysis

The two datasets were imported into R Software (version 4.4.1, R Core Team, Vienna, Austria) where one researcher validated and cleaned the data prior to analysis. Using the GPA dataset (N = 23,896), researchers compared cumulative and term GPA for the PSs and NPSs with a Welch two-sample *t*-test. Next, researchers analyzed descriptive data in the pantry dataset (N = 852) and employed logistic (logit) and multiple regression for stepwise variable selection (Hocking 1976) using biological sex, age, classification, and frequency as the explanatory variables. The response for the logistic regression models was the binary GPA (1 = high; 0 = low) with "high" being a GPA greater or equal to 2.0, 2.5, and 3.0, separately. The response for the multiple regression model was the quantitative GPA (range of 0 to 4.0). Lastly, researchers analyzed the following explanatory variables in the pantry dataset with quantitative GPA as the response variable: biological sex, age, frequency, classification, Pell Grant eligibility, college, athlete status, citizenship, residency, ethnicity/race, honors, and first-generation status using the least absolute shrinkage and selection operator (LASSO) technique (Tibshirani 1996). The purpose of the LASSO method is to reduce the coefficients of the least relevant predictor variables to zero, which selects the best model for the data and simultaneously provides the prediction.

3. Results

3.1. GPA of Pantry Shoppers and Non-Pantry Shoppers

The GPA dataset was analyzed for differences in the 2021–2022 cumulative and term GPAs to determine findings related to academic success in PSs and NPSs. The cumulative GPA dataset had unequal variance ($F(22{,}960, 847) = 1.1713$, $p = 0.0019$). There was no difference in the cumulative GPA between PSs and NPSs (Table 1).

Table 1. Institution cumulative and term GPA of pantry shoppers and non-pantry shoppers, 2021–2022.

GPA	Pantry Shopper (n = 849) Mean GPA	SD	Non-Pantry Shopper (n = 23,047) Mean GPA	SD	t Value	*df*	*p* Value
Cumulative	3.001	0.808	3.016	0.874	0.518	921.8	0.60
Fall Term	3.018	1.012	2.919	1.123	−2.235	581.69	0.03 *
Spring Term	3.021	0.961	2.954	1.112	−1.466	484.57	0.14
Summer Term	3.142	1.116	3.219	1.059	0.698	8367.0	0.48

df, degrees of freedom; GPA, grade point average. * $p < 0.05$. Welch two-sample *t*-test.

Subsequently, researchers analyzed institutional term GPAs for the fall 2021–2022 semester and found the data had unequal variance ($F(20{,}932, 546) = 1.2316$, $p = 0.0010$). Students who shopped in the campus pantry had a significantly higher fall term GPA ($p = 0.03$) than students who did not shop in the pantry. There were no significant differences between PSs and NPSs for GPA in the 2021–2022 spring or summer terms (Table 1).

3.2. Modeling Student Factors and Academic Success

First, researchers conducted a descriptive analysis of participants in the pantry dataset (N = 852). Most of the participants were female (68%), Hispanic (32%), of senior classification (34.3%), US citizens and Texas residents (88.7%, 88.5%), 22.9 years of age (mean),

first-generation students (43.8%), and Pell Grant-eligible (59.5%) with a GPA $\geq$ 3.0 (56%) (Table 2).

Table 2. Characteristics of campus food pantry shoppers in models for academic success, 2021–2022 (N = 852).

Characteristics	N (%)
Female	582 (68.3)
Ethnicity/race	
Hispanic	276 (32.0)
White	215 (25.2)
Black	207 (24.3)
International	78 (9.5)
Multiple races	38 (4.5)
Asian	24 (2.8)
Student classification	
Freshman	115 (13.5)
Sophomore	178 (20.9)
Junior	200 (23.5)
Senior	292 (34.3)
Master's	57 (6.7)
Doctoral	10 (1.2)
Pell Grant eligibility	507 (59.5)
Honors student	69 (8.0)
First-generation status	
First-generation	373 (43.8)
Continuing generation	274 (32.2)
Unknown	205 (24.1)
Athlete	75 (8.8)
College affiliation	
Science and Engineering Tech	202 (23.7)
Criminal Justice	136 (16.0)
Health Sciences	124 (14.6)

Pantry shoppers were primarily affiliated with the College of Science and Engineering Technology (24%), the College of Criminal Justice (16%), and the College of Health Sciences (15%). The frequency of pantry use (mean = 2.227/year) ranged from one to nine visits, with 53% of students shopping once per year. Students shopped in the pantry primarily in the fall (n = 847, 60%), followed by spring (n = 463, 33%) and summer (n = 97, 7%).

Using the pantry dataset (N = 852), researchers modeled the following variables in three sequential logistic regressions: biological sex, age, frequency of pantry shopping, and classification with a response variable of different binary cut-offs, with a GPA $\geq$ 2.0, 2.5, and 3.0 as 1 and 0 otherwise (academic success vs. not). In the first model, age (p = 0.03) and student classification ($p < 0.001$) were significant predictors for academic success (GPA $\geq$ 2.0 vs. not). The frequency of pantry shopping and biological sex were not significant. In the second model with age, biological sex, frequency of pantry shopping, and classification as predictor variables and the response variable, academic success (GPA $\geq$ 2.5 vs. not), results showed that biological sex (p = 0.002) and student classification ($p < 0.001$) were significant predictors for academic success (GPA $\geq$ 2.5). Age and frequency of pantry shopping were not significant. Lastly, researchers created a third model with age, biological sex, frequency

of pantry shopping, and student classification as variables to predict academic success (GPA $\geq$ 3.0 vs. not). In this model, biological sex ($p < 0.001$), frequency of pantry shopping ($p = 0.03$), and student classification ($p < 0.001$) were significant predictors of academic success (GPA $\geq$ 3.0). Age was not a significant predictor (Table 3).

Table 3. Parameter estimates for academic success (GPA $\geq$ 3.0) in pantry shoppers, 2021–2022 (N = 852).

Coefficients	Estimate	SE	z Value	Pr (>|z|)
Intercept	−1.1459	0.5364	−2.136	0.03 *
Biological sex	0.7837	0.1609	4.869	$p < 0.001$ ***
Age	−0.0279	0.0232	−1.203	0.22
Frequency	0.0946	0.0439	2.152	0.03 *
Classification				
Sophomore	1.0305	0.2615	3.940	$p < 0.001$ ***
Junior	1.1526	0.2609	4.418	$p < 0.001$ ***
Senior	1.7486	0.2592	6.746	$p < 0.001$ ***
Master's	3.8324	0.6190	6.191	$p < 0.001$ ***
Doctorate	16.7973	444.2914	0.038	0.97

*** $p < 0.001$, * $p < 0.05$.

The overall multiple regression model was significant (F(8, 842) = 30.95, $p < 0.001$). Predictor variables included age, biological sex, frequency of pantry shopping, and student classification. Researchers showed that biological sex ($p < 0.001$), age ($p = 0.03$), and classification ($p < 0.001$) were significant predictors of academic success. However, the frequency of pantry shopping was not significant ($p = 0.06$) (Table 4). Researchers kept the full model (AIC = 597.92, which is the minimum). The adjusted r-squared value was 0.2213, meaning that academic success (GPA) can be explained by its linear relationship with the predictor variables at 22.13%. There were no problems with overfitting the model.

Table 4. Parameter estimates for academic success (continuous GPA) in pantry shoppers, 2021–2022 (N = 852).

Coefficients	Estimate	SE	*t* Value	Pr (>|t|)
Intercept	2.36	0.157	15.03	$p < 0.001$ ***
Biological sex	0.19	0.052	3.86	$p < 0.001$ ***
Age	−0.02	0.007	−2.21	0.03 *
Frequency	0.03	0.013	1.90	0.06
Classification				
Sophomore	0.65	0.084	7.71	$p < 0.001$ ***
Junior	0.74	0.083	8.84	$p < 0.001$ ***
Senior	0.99	0.080	12.36	$p < 0.001$ ***
Master's	1.50	0.131	11.52	$p < 0.001$ ***
Doctorate	1.75	0.251	7.33	$p < 0.001$ ***

*** $p < 0.001$, * $p < 0.05$.

Finally, researchers applied the LASSO method for variable selection to generate a model using the following predictor variables: biological sex, age, frequency of pantry shopping, student classification, Pell Grant eligibility, college affiliation, athlete status, citizenship, residency, race/ethnicity, honors, and first-generation status. The continuous

response variable was the cumulative GPA. Researchers showed that biological sex, age, frequency of pantry shopping, student classification, college affiliation, residency, honors, and first-generation status were significant predictors of academic success (penalty tuning parameter lambda = 0.01587514). Pell Grant eligibility, athlete status, citizenship, and race/ethnicity did not predict academic success in the LASSO model (Table 5). Researchers used the minimum lambda from the cross-validation process instead of 1se lambda, intending to leave more predictor variables in the model.

Table 5. Variable selection matrix to predict academic success in pantry shoppers, 2021–2022 (N = 852).

Variable	Parameter
Intercept	1.29414346
Biological sex	0.17047740
Age	−0.00440762
Frequency of pantry shopping	0.01763445
Student classification	0.26288805
Pell Grant eligibility	0
College	−0.01544304
Athlete	0
Citizenship	0
Residency	0.04553195
Race/ethnicity	0
Honors	0.63768208
First-generation status	0.01593955

4. Discussion

This research aimed to describe the relationship between a campus food pantry and academic performance, describe the characteristics of student pantry shoppers, and develop a model to predict academic success. To understand the finding of no difference in the cumulative GPA and the significantly higher GPA of PSs relative to NPSs in the fall term, we assumed that PSs were students at risk for FI or food-insecure. Similar to Andre et al. (2024), a small percentage (3.5%) of our students shopped in the campus food pantry during 2021–2022. However, in 2023, 60% of surveyed students at our university were classified as having a low or very low food security status (Fletcher and Cornett 2024). Given this recent estimate of FI prevalence and considering the economic effects of COVID-19 and other relevant findings about FI at universities (Broton and Cady 2020; Moore et al. 2020; Nikolaus et al. 2020), it is likely that 40–50% of students were at risk for FI or could have been classified as food-insecure in 2021–2022. Thus, the high number of students at risk for FI in the NPS group may have lowered the GPA in the group. Many of the students who shopped in the pantry exhibited sociodemographic features similar to food-insecure students, such as being of the female sex, having first-generation status, and financial need. Thus, the university may want to focus efforts on promoting food assistance programs to marginalized students at risk for FI to assist more students with healthy food access on campus.

Pantry shoppers had a higher GPA in the fall and no difference in GPAs from NPSs for cumulative or spring and summer term GPAs. This finding was unexpected and inconsistent with research showing that students with FI often earn lower GPAs (Beam and Johnson 2023; Cedric et al. 2023; Hickey et al. 2019; Woerden et al. 2019; Zigmont et al. 2020). Shopping in the campus food pantry may have attenuated the effects of FI in the PS group, resulting in similar or higher academic performance compared to NPSs. Also, in the

fall of 2021, students made twice as many trips to the food pantry than in the spring and eight times as many as in the summer terms. This produced a larger dataset in the fall and may have increased the statistical power to find a difference in GPAs.

Another explanation for the findings about the higher fall term GPAs is the possible attenuation of symptoms of depression in PSs. Upon returning to in-person classes in 2021, PSs may have consumed a higher-quality diet, which is known to reduce depression and anxiety by providing essential nutrients to produce beneficial neurotransmitters that regulate depression. Thus, a healthier diet in PSs may have reduced symptoms of depression and contributed to improved academic performance (Alston et al. 2023). Additionally, during the pandemic, pantry leaders collaborated with the university's student counseling center to promote health and wellness to students. These findings were consistent with related research about the association of overall diet quality, frequent breakfast consumption, and reductions in EDNP foods with academic success (Burrows et al. 2017; Reuter et al. 2021; Vilches et al. 2023).

Conversely, two studies about the effectiveness of food pantries where food was administered through food scholarship programs showed mixed results for decreasing FI and improving academic success. One study reported that students showed improvement in nutrient intake and diet quality, but there was no change in the prevalence of FI (Alexis et al. 2022). Food was distributed twice per month for ten weeks as intended, but the intervention may have been too short to see a difference in the prevalence of FI. Alternately, Goldrick-Rab and colleagues report that the Houston Food Scholarship did not decrease FI or increase academic performance or well-being; however, student attendance lagged in the program (Goldrick-Rab et al. 2020). One consistency between Goldrick-Rab's study and our research is low program utilization. There were no differences in GPAs between program participants in most time periods, except our research found that PSs had a significantly higher GPA than NPSs in the fall term. Some student demographic factors were similar between the studies, i.e., primarily females, older students (23 or 24 years), and a non-Hispanic majority of participants. Additional research is needed to investigate the efficacy of programs supported by campus food pantries to further assist students at risk of FI.

Our findings showed that PSs were demographically similar to students at risk for FI. For example, participants were primarily female (68.3%), financial aid-eligible (59%), first-generation (43.8%), and ethnically diverse students who were Hispanic (32%), white (25.2%), Black (24.3%), and international (9.5%). The findings about ethnicity differ slightly from studies that indicate Black students have a higher prevalence of FI than white students (El Zein et al. 2019; Miles et al. 2017; Payne-Sturges et al. 2018; Weaver et al. 2020). Female students were more likely to shop in the campus food pantry possibly because they have higher rates of FI. More research is needed to investigate why female students have higher rates of FI and why they seek food assistance more often than males. Most students in the PS group exhibited financial needs, as evidenced by their eligibility for a Pell Grant.

Other students at risk for developing FI included freshmen, first-generation students, and athletes, all of whom were underrepresented in the PS group. For example, first-generation students and freshmen comprised 43.8% and 13.5% of the PS group, respectively. However, university reports indicate that 53% of students enrolled in the fall of 2021–2022 were of first-generation status, and 17% of students were freshmen (SHSU Office of Data Analytics and Decision Support 2024). Freshman PSs were at substantial risk for FI because of new and increased responsibilities (financial and personal) related to college attendance and self-care. Beginning in the fall of 2023, university leaders expanded efforts to connect freshmen to resources at student orientation meetings in every college. Additional study is needed to determine participation by freshmen after the intervention at orientation. Currently, many athletes receive pantry food boxes via the athletic department. In the future, the impact of the athletes' food boxes needs to be assessed in conjunction with the frequency of shopping in the campus pantry. The university must look for new ways to increase shopping in the pantry by students at risk for FI, including students representing

all ethnicities, freshmen, first-generation students, and athletes, to promote good health and academic success.

Researchers analyzed logistic and multiple regression models for predicting academic success in PSs with the following variables: age, classification, frequency of pantry shopping, and biological sex. Four additional predictors were identified in the LASSO regression including college, residency, honors, and first-generation status. In this research, we found that pantry shopping frequency was a predictor for academic success. This is consistent with Weaver et al.'s (2020) finding that food security was associated with the highest GPAs. Also, our research did not find an association between ethnicity or financial aid eligibility and higher GPAs, similar to those of Weaver et al. (2020). These models may be useful in developing programs geared to assist PSs at risk for lower academic performance, such as the youngest students. Also, using the college affiliation data obtained through this research, pantry staff could develop or expand existing programs to reach colleges with low pantry participation. Although these models explain the association of many student factors with GPAs, they do not provide causal explanations for academic success. Further investigation is needed to develop interventions to increase food security on campus and improve student success.

4.1. Study Limitations

This study has limitations that offer opportunities for future investigation. Researchers implemented a cross-sectional design using secondary data sources, so the study did not identify causal factors. However, the exploratory nature of this work may be beneficial in planning future research and programs to reduce the prevalence of FI at this university. The researchers' ability to draw conclusions about the impact of FI was limited because FI was not collected or measured in the study. However, the campus food pantry was related to FI, as the pantry was an intervention taken to improve student food access, which has the potential to impact academic performance. Future investigations could determine the current prevalence of FI among PSs. However, some students may decline to shop in the pantry if they feel stigmatized or labeled as food-insecure. The secondary data sources could have inaccuracies because the researchers did not collect the data. However, the researchers used previous student-provided university data, actual (not reported) GPAs, and student identification card swipes to determine the frequency of pantry shopping. The study design did not eliminate confounders, which may have resulted in an overestimation of the relationship between the campus food pantry and academic performance. For example, researchers did not consider the availability of student transportation or off-campus food assistance sources because this information was not available. Due to the rural geography and the differences in campus cultures of the university where the research occurred, the results of this study are not generalizable to other universities.

4.2. Implications for Research and Practice

Based on the findings of this study, prospective studies are needed to investigate holistic multicomponent programs that may attenuate FI and reduce its impact on student performance and mental and physical health conditions. Also, further study is needed to identify barriers to shopping in the food pantry including the stigma associated with asking for food assistance. University administrators could use the findings from this study to design programs to reduce FI on college campuses and reach marginalized students who have risk factors for FI. Also, local, state, and federal policymakers may report the findings of this study as they advocate for more food assistance opportunities and inform future policies that foster food security in university environments.

5. Conclusions

This study illustrates that campus food pantry shoppers at our university achieved academic success despite exhibiting risk factors for FI following the COVID-19 pandemic. Also, this research identified sociodemographic factors of PSs which were similar to students

who are food-insecure or at risk for FI, including first-generation status, female, freshman classification, and financial need. Targeted multicomponent programs are necessary to reach university students who are at risk for FI so students may access food assistance and achieve success during college and in the future.

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References

Alexis, Torrey D., Deborah Unruh, Wanyi Wang, Jayna M. Dave, Derek C. Miketinas, Tzu-An Chen, and Carolyn E. Moore. 2022. Implementation of a food scholarship program improves nutrient intake and dietary quality of college students. *Journal of American College Health* 70: 2281–88. [CrossRef] [PubMed]

Alston, Lucia, Kimberly Powell, Jason O'Briant, Ellie Thompson, Raelyn Dowdy, Mackenzie Mendenhall, and Lamis Jomaa. 2023. P12-002-23 Food insecurity and campus food pantry use among college students during and post the COVID-19 pandemic: A qualitative study. *Current Developments in Nutrition* 7: 143. [CrossRef]

American College Health Association. 2021. *American College Health Association-National College Health Assessment III: Undergraduate Student Reference Group Executive Summary Spring 2021*. Silver Spring: American College Health Association. Available online: https://www.acha.org/wp-content/uploads/2024/07/NCHA-III_SPRING_2021_UNDERGRADUATE_REFERENCE_GROUP_EXECUTIVE_SUMMARY.pdf (accessed on 23 May 2024).

Andre, Evansha, Li Yingru, Li Dapeng, J. Scott Carter, Amy Donley, and Peng Ng Boon. 2024. Food insecurity within a public university and the role of food assistance programs amid the global pandemic. *Social Sciences* 13: 38. [CrossRef]

Bardenhagen, Chris, Courtney Pinard, Rich Pirog, and Amy Yaroch. 2017. Characterizing rural food access in remote areas. *Journal of Community Health* 42: 1008–19. [CrossRef]

Beam, Maria, and Raenece Johnson. 2023. Food insecurity on a college campus: Implications for academic success. *Journal of Higher Education Theory and Practice* 23: 249–60.

Broton, Katharine, and Clare Cady. 2020. *Food Insecurity on Campus*. Baltimore: Johns Hopkins Press.

Broton, Katharine, Charlotte Lenkaitis, and Sarah Henry. 2022. Universities as producers, managers, and opponents of poverty: The case of food insecurity on campus. *Georgetown Journal on Poverty Law and Policy* 29: 337–59.

Bruening, Meg, Stephanie Brennhofer, Irene Van Woerden, Michael Todd, and Melissa Laska. 2016. Factors related to the high rates of food insecurity among diverse, urban college freshmen. *Journal of the Academy of Nutrition and Dietetics* 116: 1450–57. [CrossRef]

Burrows, Tracy, Sharni Goldman, Kirrilly Pursey, and Renee Lim. 2017. Is there an association between dietary intake and academic achievement: A systematic review. *Journal of Human Nutrition and Dietetics* 30: 117–40. [CrossRef]

Camelo, Karen, and Marta Elliott. 2019. Food insecurity and academic achievement among college students at a public university in the United States. *Journal of College Student Development* 60: 307–18. [CrossRef]

Cedric, Harville, C. S. James Delores, and Burns Arné. 2023. Profile of a food-insecure college student at a major southeastern university: A randomized cross-sectional study. *Nutrients* 15: 1108.

Center for Collegiate Mental Health. 2024. *2023 Annual Report*. STA 24-147. University Park: Center for Collegiate Mental Health. Available online: https://ccmh.psu.edu/assets/docs/2023_Annual%20Report.pdf (accessed on 27 January 2024).

Chodur, Gwen, Sonali Singh, Erin E. Riordan, Sevan Kalaydjian, and Suzanna M. Martinez. 2023. Campus food pantry use may improve daily frequency of fruit and vegetable intake among California university students experiencing food insecurity. *Journal of the Academy of Nutrition and Dietetics* 24: 225–32. [CrossRef] [PubMed]

Coakley, Kathryn E., Sarita Cargas, Marygold Walsh-Dilley, and Heather Mechler. 2022. Basic needs insecurities are associated with anxiety, depression, and poor health among university students in the state of New Mexico. *Journal of Community Health* 47: 454–63. [CrossRef] [PubMed]

Coffino, Jaime A., Samantha P. Spoor, Rae D. Drach, and Julia M. Hormes. 2021. Food insecurity among graduate students: Prevalence and association with depression, anxiety and stress. *Public Health Nutrition* 24: 1889–94. [CrossRef] [PubMed]

Crutchfield, Rashida M., Ruth M. Chambers, Andrea Carpena, and Tahirah N. McCloyn. 2020. Getting help: An exploration of student experiences with a campus program addressing basic needs insecurity. *Journal of Social Distress & the Homeless* 29: 16–24.

Eicher-Miller, Heather A. 2020. A review of the food security, diet and health outcomes of food pantry clients and the potential for their improvement through food pantry interventions in the United States. *Physiology & Behavior* 220: 112871. [CrossRef]

El Zein, Aseel, Karla P. Shelnutt, Sarah Colby, Melissa J. Vilaro, Wenjun Zhou, Geoffrey Greene, Melissa D. Olfert, Kristin Riggsbee, Jesse Stabile Morrell, and Anne E. Mathews. 2019. Prevalence and correlates of food insecurity among U.S. college students: A multi-institutional study. *BMC Public Health* 19: 660. [CrossRef]

Fletcher, Carla, and Allyson Cornett. 2024. *Student Financial Wellness Survey Fall 2023 Semester Report*. Round Rock: Trellis Strategies.

Freudenberg, Nicholas, Sara Goldrick-Rab, and Janet Poppendieck. 2019. College students and SNAP: The new face of food insecurity in the United States. *American Journal of Public Health* 109: 1652–58. [CrossRef]

Goldrick-Rab, Sara, Daphne Hernandez, Vanessa Coca, Tiffani Williams, and Brianna Richardson. 2020. *Houston Food Scholarship Program Report*. Philadelphia: The Hope Center for College Community and Justice. Available online: https://saragoldrickrab.com/wp-content/uploads/2023/06/Evaluation_of_Houston_Food_Scholarship_P-1.pdf (accessed on 10 February 2024).

Golovaty, Ilya, Phyllis C. Tien, Jennifer C. Price, Lila Sheira, Hilary Seligman, and Sheri D. Weiser. 2020. Food insecurity may be an independent risk factor associated with nonalcoholic fatty liver disease among low-income adults in the United States. *The Journal of Nutrition* 150: 91–98. [CrossRef]

Hagedorn, Rebecca L., and Melissa D. Olfert. 2018. Food insecurity and behavioral characteristics for academic success in young adults attending an Appalachian university. *Nutrients* 10: 361. [CrossRef]

Hagedorn, Rebecca L., Laura H. McArthur, Lanae B. Hood, Maureen Berner, Elizabeth T. Anderson Steeves, Carol L. Connell, Elizabeth Wall-Bassett, Marsha Spence, Oyinlola Toyin Babatunde, E. Brooke Kelly, and et al. 2019. Expenditure, coping, and academic behaviors among food-insecure college students at 10 higher education institutes in the Appalachian and southeastern regions. *Current Developments in Nutrition* 3: 1. [CrossRef]

Haskett, Mary E., Suman Majumder, Dana Kotter-Grühn, and Indira Gutierrez. 2021. The role of university students' wellness in links between homelessness, food insecurity, and academic success. *Journal of Social Distress & the Homeless* 30: 59–65.

Hayden, DePorter, Moss Shayna, Puc Grace Ayo, Ayalasomayajula Kavya, and Goldman Irwin. 2023. Campus food shed: Student-led efforts at the University of Wisconsin-Madison to support food-insecure peers. *Journal of Agriculture, Food Systems, and Community Development* 12: 25–35.

Hickey, Amanda, Dena Shields, and Margaret Henning. 2019. Perceived hunger in college students related to academic and athletic performance. *Education Sciences* 9: 242. [CrossRef]

Hiller, Molly B., Donna M. Winham, Simon T. Knoblauch, and Mack C. Shelley. 2021. Food security characteristics vary for undergraduate and graduate students at a midwest university. *International Journal of Environmental Research and Public Health* 18: 5730. [CrossRef]

Hocking, R. R. 1976. The analysis and selection of variables in linear regression. *Biometrics* 32: 1–49. [CrossRef]

Hollis-Hansen, Kelseanna, Carolyn Haskins, Jessica Turcios, Michael E. Bowen, Tammy Leonard, MinJae Lee, Jaclyn Albin, Benaye Wadkins-Chambers, Cynthia Thompson, Taylor Hall, and et al. 2023. A pilot randomized controlled trial comparing nutritious meal kits and no-prep meals to improve food security and diet quality among food pantry clients. *BMC Public Health* 23: 2389. [CrossRef] [PubMed]

Idehai, Oisemujaime Victoria, Pindar Mbaya, Tammy Chung, and Trishnee Bhurosy. 2024. A systematic review of factors associated with student use of campus food pantries: Implications for addressing barriers and facilitating use. *BMC Public Health* 24: 97. [CrossRef]

Jones, Heidi E., Meredith Manze, Victoria Ngo, Patricia Lamberson, and Nicholas Freudenberg. 2021. The impact of the COVID-19 pandemic on college students' health and financial stability in New York City: Findings from a population-based sample of City University of New York (CUNY) Students. *Journal of Urban Health* 98: 187–96. [CrossRef]

Jones, John C., Lauren Linkous, Lisa Mathews-Ailsworth, Reyna Vazquez-Miller, Elizabeth Chance, Jackie Carter, and Isaac Saneda. 2024. Smart little campus food pantries: Addressing food insecurity at Virginia Commonwealth University. *Journal of Agriculture, Food Systems, and Community Development* 13: 135–51. [CrossRef]

Leung, Cindy W., Aarohee P. Fulay, Lindsey Parnarouskis, Euridice Martinez-Steele, Ashley N. Gearhardt, and Julia A. Wolfson. 2022. Food insecurity and ultra-processed food consumption: The modifying role of participation in the Supplemental Nutrition Assistance Program (SNAP). *The American Journal of Clinical Nutrition* 116: 197–205. [CrossRef]

Li, Yufei, and Samantha R. Rosenthal. 2021. Food insecurity and obesity among US young adults: The moderating role of biological sex and the mediating role of diet healthfulness. *Public Health Nutrition* 24: 5058–65. [CrossRef] [PubMed]

Liu, Junxiu, Stella S. Yi, Rienna G. Russo, Carol R. Horowitz, Donglan Zhang, Janani Rajbhandari-Thapa, Dejun Su, Lu Shi, and Yan Li. 2024. Trends and disparities in prevalence of cardiometabolic diseases by food security status in the United States. *Nutrition Journal* 23: 4. [CrossRef] [PubMed]

Ma, Xiaonan, Angela D. Liese, James Hibbert, Bethany A. Bell, Sara Wilcox, and Patricia A. Sharpe. 2017. The association between food security and store-specific and overall food shopping behaviors. *Journal of the Academy of Nutrition and Dietetics* 117: 1931–40. [CrossRef]

Manboard, Miriam, Cassandra M. Johnson, Hannah Thornton, and Lesli Biediger-Friedman. 2021. The HOME study: Understanding how college students at a Hispanic serving institution coped with food insecurity in a pandemic. *International Journal of Environmental Research and Public Health* 18: 11087. [CrossRef]

Martinez, Suzanna M., Edward A. Frongillo, Cindy Leung, and Lorrene Ritchie. 2020. No food for thought: Food insecurity is related to poor mental health and lower academic performance among students in California's public university system. *Journal of Health Psychology* 25: 1930–39. [CrossRef] [PubMed]

Martinez, Suzanna M., Gwen M. Chodur, Erin E. Esaryk, Sevan Kaladijian, Lorrene D. Ritchie, and Michael Grandner. 2022. Campus food pantry use is linked to better health among public university students. *Journal of Nutrition Education and Behavior* 54: 491–98. [CrossRef]

Maslow, A. H. 1943. A theory of human motivation. *Psychological Review* 50: 370–96. [CrossRef]

Matthew, M. Lee, Poole Mary Kathryn, M. Zack Rachel, Fiechtner Lauren, B. Rimm Eric, and L. Kenney Erica. 2023. Food insecurity and the role of food assistance programs in supporting diet quality during the COVID-19 pandemic in Massachusetts. *Frontiers in Nutrition* 9: 1007177. [CrossRef]

McArthur, Laura H., Kimberly S. Fasczewski, Elaine Wartinger, and Jordan Miller. 2018. Freshmen at a university in Appalachia experience a higher rate of campus than family food insecurity. *Journal of Community Health* 43: 969–76. [CrossRef]

Miles, Rhen, Bowen McBeath, Stephanie Brockett, and Paul Sorenson. 2017. Prevalence and predictors of social work student food insecurity. *Journal of Social Work Education* 53: 651–63. [CrossRef]

Moore, Carolyn, Kathleen Davis, and Wanyi Wang. 2020. Low food security present on Texas college campuses despite high nutrition literacy. *Current Developments in Nutrition* 4: 246. [CrossRef]

Nikolaus, Cassandra J., Ruopeng An, Brenna Ellison, and Sharon M. Nickols-Richardson. 2020. Food security among college students in the US: A scoping review. *Advances in Nutrition* 11: 327–48. [CrossRef] [PubMed]

O'Neill, Marissa, and Jen Maguire. 2017. College students self-reported food insecurity and correlations with health and academic performance. *Journal of Behavioral & Social Sciences* 4: 34–40.

Olfert, Melissa D., Rebecca L. Hagedorn, and Ayron E. Walker. 2021. Food insecurity risk among first-generation college students at an Appalachian University. *Journal of Appalachian Studies* 27: 202–19. [CrossRef]

Owens, Meghan R., Francilia Brito-Silva, Tracie Kirkland, Carolyn E. Moore, Kathleen E. Davis, Mindy A. Patterson, Derek C. Miketinas, and Wesley J. Tucker. 2020. Prevalence and social determinants of food insecurity among college students during the COVID-19 pandemic. *Nutrients* 12: 2515. [CrossRef]

Payne-Sturges, Devon C., Allison Tjaden, Kimberly M. Caldeira, Kathryn B. Vincent, and Amelia M. Arria. 2018. Student hunger on campus: Food insecurity among college students and implications for academic institutions. *American Journal of Health Promotion* 32: 349–54. [CrossRef]

Peterson, Nicole, Andrea Freidus, and Dmitry Tereshenko. 2022. Why college students don't access resources for food insecurity: Stigma and perceptions of need. *Annals of Anthropological Practice* 46: 140–54. [CrossRef]

Pradhananga, Nila, Kritee Niroula, Jean Pierre Enriquez, Erin McKinley, and Bailey Houghtaling. 2023. Prevalence, perceptions, and recommendations for addressing student food insecurity: A mixed-methods investigation. *Journal of Nutrition Education and Behavior* 55: 39. [CrossRef]

Radtke, Marcela D., Francene M. Steinberg, and Rachel E. Scherr. 2024. Methods for assessing health outcomes associated with food insecurity in the United States college student population: A narrative review. *Advances in Nutrition* 15: 100131. [CrossRef]

Raskind, Ilana G., Regine Haardörfer, and Carla J. Berg. 2019. Food insecurity, psychosocial health and academic performance among college and university students in Georgia, USA. *Public Health Nutrition* 22: 476–85. [CrossRef]

Reed, Jill R., Bernice C. Yates, Julia Houfek, Wayne Briner, Kendra K. Schmid, and Carol Pullen. 2016. A review of barriers to healthy eating in rural and urban adults. *Online Journal of Rural Nursing and Health Care* 16: 122–53. [CrossRef]

Reuter, Peter R., Bridget L. Forster, and Sierra R. Brister. 2021. The influence of eating habits on the academic performance of university students. *Journal of American College Health* 69: 921–27. [CrossRef] [PubMed]

Saha, Sanjoy, Hilary Okafor, Lesli Biediger-Friedman, and Andrew Behnke. 2023. Association between diet and symptoms of anxiety and depression in college students: A systematic review. *Journal of American College Health* 71: 1270–80. [CrossRef]

Sanders, Catherine E., Tatevik Markosyan, Kristin E. Gibson, Allison R. Byrd, and Alexa J. Lamm. 2023. Improving sustainable food access and availability in rural communities: An assessment of needed resources. *Sustainability* 15: 6293. [CrossRef]

Scheitzer, Zoe, Christine Tonhu Nguyen, Rachel Sumekh, and May Wang. 2022. College Campus Food Pantries: Learnings from a 2021 Survey. Available online: https://www.swipehunger.org/wp-content/uploads/2022/04/College-Campus-Food-Pantries-Learnings-from-a-2021-Survey.pdf (accessed on 16 March 2024).

Shaabneh, Kamar, Jaymee Gonzales, Ronesia Williams, Cassandra M. Johnson, J. Lauren Butler, and Lesli Biediger-Friedman. 2023. Evaluation of a student-led food pantry's impact on food security among international college students. *Journal of Nutrition Education and Behavior* 55: 51. [CrossRef]

Shi, Yumeng, Amanda Grech, and Margaret Allman-Farinelli. 2022. Diet quality among students attending an Australian university is compromised by food insecurity and less frequent intake of home cooked meals. A cross-sectional survey using the validated healthy eating index for Australian adults (HEIFA-2013). *Nutrients* 14: 4522. [CrossRef]

SHSU Office of Data Analytics and Decision Support. 2024. Fact Book. Available online: https://www.shsu.edu/dept/data/fbenrollment (accessed on 5 September 2024).

Simmet, Anja, Julia Depa, Peter Tinnemann, and Nanette Stroebele-Benschop. 2017. The dietary quality of food pantry users: A systematic review of existing literature. *Journal of the Academy of Nutrition and Dietetics* 117: 563–76. [CrossRef]

Simon, Ashley, Keiko Goto, Jenny Breed, and Stephanie Bianco. 2018. Factors associated with food insecurity and food assistance program participation among university students. *California Journal of Health Promotion* 16: 73–78. [CrossRef]

Soldavini, Jessica, Hazael Andrew, and Maureen Berner. 2022. Campus-based food insecurity: The case of international students at a southeastern university. *Journal of Student Affairs Research and Practice* 59: 338–51. [CrossRef]

Swipe Out Hunger. 2024. Hunger Free Campus Bill. Available online: https://www.swipehunger.org/hungerfree/ (accessed on 16 March 2024).

The Hope Center for College, Community, and Justice. 2021. *#RealCollege 2021: Basic Needs Insecurity during the Ongoing Pandemic*. Philadelphia: The Hope Center for College Community and Justice. Available online: https://hope.temple.edu/sites/hope/files/media/document/HopeSurveyReport2021.pdf (accessed on 21 May 2024).

Tibshirani, Robert. 1996. Regression shrinkage and selection via the Lasso. *Journal of the Royal Statistical Society Series B: Statistical Methodology* 58: 267–88. [CrossRef]

Umeda, Masataka, Sarah L. Ullevig, Eunhee Chung, Youngdeok Kim, Tanya J. Escobedo, and Christopher J. Zeitz. 2020. Depression mediates the relationship between food insecurity and pain interference in college students. *International Journal of Environmental Research and Public Health* 18: 78. [CrossRef] [PubMed]

USDA. 2023. Food Security in the US. Available online: https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/key-statistics-graphics/#map (accessed on 5 February 2024).

USDA Economic Research Service. 2023. Definitions of Food Security. Available online: https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/definitions-of-food-security/ (accessed on 28 January 2024).

USDA Economic Research Service. 2024. Rural-Urban Continuum Codes. Available online: https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/rural-urban-continuum-codes/ (accessed on 27 October 2023).

Vilches, Jazmin, J. Christensen, D. Aguilar-Alvarez, J. Chan, and J. Gautney. 2023. Increased intake of alpha-linolenic acid is associated with higher exam scores. *Journal of the Academy of Nutrition and Dietetics* 123: A67. [CrossRef]

Weaver, Robert R., Nicole A. Vaughn, Sean P. Hendricks, Penny E. McPherson-Myers, Qian Jia, Shari L. Willis, and Kevin P. Rescigno. 2020. University student food insecurity and academic performance. *Journal of American College Health* 68: 727–33. [CrossRef] [PubMed]

Woerden, Irene, Daniel Hruschka, and Meg Bruening. 2019. Food insecurity negatively impacts academic performance. *Journal of Public Affairs* 19: e1864. [CrossRef]

Wolfson, Julia A., Noura Insolera, Alicia Cohen, and Cindy W. Leung. 2022. The effect of food insecurity during college on graduation and type of degree attained: Evidence from a nationally representative longitudinal survey. *Public Health Nutrition* 25: 389–97. [CrossRef]

Zigmont, Victoria A., Abigail Linsmeier, and Peggy Gallup. 2020. Food insecurity and associated health and academic measures amoung college students in Connecticut. *American Journal of Health Studies* 35: 286–95.

Zigmont, Victoria A., Jennifer Anziano, Elizabeth Schwartz, and Peggy Gallup. 2023. Captive market pricing and lack of transportation: A survey of undergraduate food insecurity at a public university in New England. *American Journal of Health Promotion* 37: 313–23. [CrossRef]

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