Food insecurity among students at the University of the Free State, South Africa

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Abstract

Objective*:* The objective of this study was to investigate food insecurity in students in a developing country with high national food insecurity.

Design: This was a cross-sectional survey.

Subjects and setting: Registered students at the University of the Free State were invited to participate. Thirty-one thousand and fourteen students were enrolled in 2013. One thousand, four hundred and sixteen students completed a self-administered web-based questionnaire.

Outcome measures: Food insecurity was assessed using a one-item measure, i.e. the Australian National Nutrition Survey, and a 10-item measure, i.e. the United States Department of Agriculture Community Food Security Assessment Toolkit. Associations of food insecurity with biographical attributes, food procurement measures and coping strategies were determined using the chi-square test and multivariate logistic regression analysis.

Results*:* The prevalence of food insecurity according to the one-item measure was 65%. Using the 10-item measure, 60% of the students experienced food insecurity "with hunger", and 26% food insecurity "without hunger". The highest prevalence of food insecurity was in black and coloured, undergraduate, first-generation and male students, as well as in students who were unmarried, unemployed and those relying on loans or bursaries. Using the regression model, the strongest significant predictors of food insecurity were race, gender, being a first-generation student, not having enough food money, having borrowed food money from parents, having asked for food and having sold belongings to obtain food.

Conclusion: Severe food insecurity in students may be contributing to the high attrition rates experienced by universities in South Africa. Urgent intervention is required, as not having access to enough nutritionally adequate and safe food could be one of the reasons why more than 50% of South African university students never graduate.

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Introduction

Recent studies have identified food insecurity in students as an emerging "skeleton in the university closet" in high-income Western countries with relatively low national food insecurity, including Australia,[1] Canada[2] and the USA.[3-5] Food insecurity was found to be consistently higher in students in these countries than that reported in the general population. Hardly any studies have reported on the scope of the problem at universities in South Africa. While South Africa is food secure as a country, in other words able to produce, import, retain and sustain sufficient food to support its population with minimum per capita nutritional standards, this is not the case at household level.[6] In 2012, 54% of South African households were found to be food insecure, i.e. 28% were at risk of hunger and 26% experienced hunger.[7]

Food insecurity is defined as the "limited or uncertain availability of nutritionally adequate and safe foods, or the limited or uncertain ability to acquire acceptable foods in socially acceptable ways,"[8] and interpreted as "not having sufficient food, experiencing hunger as a result of running out of food and being unable to afford more, eating a poor-quality diet as a result of limited food options, and anxiety about acquiring food or having to rely on food relief.[9] Food insecurity represents a continuum. Sustained food insecurity eventually becomes hunger.[8]

A large body of empirical evidence with regard to schoolchildren supports the fact that poor nutrition and food insecurity negatively affect cognitive function and academic performance.[10-12] However, food insecurity in students at higher education institutions is a neglected field of research, possibly owing to the traditional, unstated

assumption that higher education, being an expensive, elite and non-mandatory educational avenue, would not be pursued by students if they did not already have access to the basic needs of food, shelter and clothing.[1] However, over the last decade, more and more tertiary institutions worldwide have had to establish food aid campaigns to help feed their students.[2,3] Tertiary enrolment figures in sub-Saharan Africa are the lowest in the world,[13] and the graduation rate at the 23 universities in South Africa is currently only 15%, while dropout rates are approximately 50%.[14] As food is a basic physiological need,[14] it is feasible that food insecurity may contribute to poor student success in South Africa.

The prevalence and severity of food insecurity in students at a South African university was assessed in this study as a baseline for further investigation into the causes and consequences thereof. The study was conducted at the University of the Free State, in the Free State province, where food insecurity in the general population is higher (at 61%)7 than the national average.

Method

Design and participants

A descriptive quantitative survey was conducted. Students (31 014) registered at the University of the Free State in 2013 were invited to complete a self-reported, web-based questionnaire, which was made available on the student portal for three weeks in April and May 2013. A total of 1 416 students provided online informed consent and completed the questionnaire. Approval for the study was obtained from the ethics committee of the Faculty of Health Sciences, University of the Free State.

Data collection

The self-administered questionnaire was developed based on previous research[1,13,15-17] to assess relevant biographical factors, food procurement measures and strategies to overcome barriers associated with food insecurity and hunger in university students, particularly in the local context. To address the well-recognised limitations of capturing the complexity of food insecurity with a self-administered questionnaire, responses in this study were analysed in terms of two different food insecurity measures, namely a single-question measure, adapted by Hughes et al[1] for university students from the Australian National Nutrition Survey, and a more sensitive 10-item food security scale (a multi-question measure) from the United States Department of Agriculture Community Food Security Assessment Toolkit,[18] also adapted by Hughes et al[1] for university students (Table I). The latter tool identifies two levels of food insecurity, namely low food security (food insecurity "without hunger"), which involves "reduced quality, variety or desirability of the diet, with little or no indication of reduced food intake"; and very low food security, which involves disrupted eating patterns and reduced food intake (food insecurity "with hunger").[19] The single-item measure combines elements from questions in the multi-item measure relating to both these levels of food-insecurity.

Table I: Estimating the prevalence and severity of food insecurity

Single-item measure

Respondents were classified as food insecure if they answered "yes" to the following question: "In the last 12 months, during the academic term, were there any times that you ran out of food and couldn't afford to buy any more?"[1]

Multi-item measure

"Household" in the multi-item measure was defined as referring to where a respondent lived mostly during the academic term for the purposes of this study. Respondents were classified as having low food security, or being food insecure "without hunger", if they answered "often true" or "sometimes true" to any of the following statements:[1,19]

- "I worried that my food would run out before I had money to buy more"
- "I couldn't afford to eat balanced meals"
- "The food that we bought in the household just didn't last, and we didn't have money to get more"

with the options being:

- Often true
- Sometimes true
- Never true
- I don't know
- I don't want to answer

and/or if they answered "sometimes not enough to eat" or "often not enough to eat" in response to the following statement:

- Which of these statements best describes the foods eaten in your household?"

with the options being:

- "Enough of the kinds of food we want to eat"
- "Enough, but not always the kinds of food we want to eat"
- "Sometimes not enough to eat"
- "Often not enough to eat"
- "I don't want to answer".

Respondents were classified as being very food insecure, or being food insecure "with hunger", if they answered "yes" to any of the following questions (other options were "no" or "I don't know"):

- "Did you or other adults in your household ever decrease the size of your meals or skip meals because there wasn't enough money to buy food"?
- "Were you ever hungry, but didn't eat because you couldn't afford enough food?"
- "Did you lose weight because you didn't have enough money for food?"
- "Did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?"

Respondents were classified as food secure if none of the above applied.

Biographical attributes which predispose students to food insecurity, and the coping mechanisms students adopted to deal with the condition, were also explored.

A pilot study was conducted using 10 randomly selected students (five English and five Afrikaans, i.e. to reflect the two official languages of instruction at the university. All students must be conversant in at least one of these). The students were contacted and asked to complete the questionnaire via a direct URL link before the questionnaire was published live. Feedback from the participants was used to ensure that the items were correctly understood within the cultural and linguistic context of the participants. The pilot study data were not included in the analysis.

Table II: The distribution of food insecurity prevalence across biographical attributes

Variable	n (%),[%]*	By multi-item measure			p-value**	By single-item measure	
		Food secure	Food insecure without hunger	Food insecure with hunger		Food insecure	p-value**
		%	%	%		%	
Total student sample	1 416	16	24.5	59.5		65.1	
Gender (n = 1 392)							
Male	864 (62.3), [61.7]	12.6	21.6	65.8	< 0.001	70.5	< 0.001
Female	518 (37.5), [38.2]	17.7	27.2	55.1		60.4	
Ethnicity (n = 1 388)							
African	967 (69.7), [63.0]	5.8	22.5	71.7	< 0.001	79.0	< 0.001
White	319 (23.0, [29.0]	42.6	32.0	25.4		23.6	
Coloured	81 (5.8), [5.0]	19.8	23.5	56.8		65.6	
Indian	17 (0.9), [0.8]	47.1	29.4	23.5		23.5	
Chose not to indicate	4 (0.6), [1.0]						
Relationship status (n = 1 145)							
Single	876 (62.6)	14.0	23.7	62.2	0.026	67.4	< 0.001
In a relationship, but not married	485 (34.5)	18.8	26.2	55.1		61.3	
Married	30 (2.1)	16.7	33.3	50.0		34.5	
Other	7 (1.0)	37.5	37.5	25.0		25.0	
Level of study (n = 1 392)							
Undergraduates	1 256 (90.2), [74.0]	14.7	24.6	60.5	0.001	65.8	< 0.001
Postgraduates	136 (9.8), [21.0]	25.0	27.9	47.1		50.7	
Faculty of study (n = 1 400)							
Economics and management sciences	318 (22.7), [15.4]	16.0	27.0	56.9	< 0.001	66.1	< 0.001
Education	152 (10.9), [24.0]	13.2	23.0	63.8		66.4	
Health sciences	101 (7.2), [8.4]	36.6	29.7	33.7		38.4	
Law	86 (6.1), [10.8]	14.0	25.6	60.5		58.3	
Natural and agricultural sciences	341 (24.4), [18.3]	12.6	23.8	63.6		70.2	
Humanities	388 (27.7), [22.4]	14.2	23.5	62.4		65.6	
Theology	14 (1.0), [0.9]	28.6	21.4	50.0		50.0	
First-generation student (n = 1 415)							
Yes	682 (57.0)	8.3	24.9	66.8	< 0.001	72.6	< 0.001
No	733 (43.0)	23.0	24.6	52.4		27.4	
Who pays for the tuition fees?* (n = 1 415)**							
Self	124 (8.8)	16.4	25.5	58.2	< 0.001	65.5	< 0.001
Parents, relatives or a benefactor	661 (46.7)	18.8	25.4	55.8		60.5	
Bank loan	138 (9.8)	18.5	18.5	63.1		68.3	
Other type of loan	239 (16.9)	4.2	21.1	74.7		80.5	
Merit bursary	205 (14.5)	13.9	33.7	52.5		60.6	
Other type of bursary	300 (21.2)	9.6	26.8	63.6		70.5	
Employer	23 (1.6)	36.4	18.2	45.5		45.5	
Employed (n = 1 372)							
No	1 141 (83.2)	14.0	25.3	60.8	< 0.001	66.1	< 0.001
Yes	231 (16.8)	27.5	22.2	50.3		51.3	
Supports someone else financially (n = 1 413)							
No	1 108 (78.4)	17.0	25.5	57.6	0.004	63.2	0.044
Yes	305 (21.6)	12.5	21.3	66.2		69.5	

* Percentages in square brackets indicate the presentation of the row group in the entire university student population (n = 31 014) to indicate representation

** p-value for the chi-square analysis of the cross-tabulation of all the categorical variables under a particular group heading (p-value < 0.010 represents statistical significance)

*** Students could choose more than one option (p-values computed only for n = 1 137 where respondents chose only one option)

Data analysis

Data were analysed using Statistical Analysis System®. Descriptive statistics were calculated, and chi-square analysis (or Fisher's exact probability test for small cell counts) was used to determine the association between food insecurity and a range of socioeconomic and demographic attributes, food procurement measures and coping strategies with respect to cross-tabulation of the categorical variables. For the sake of space, > 2 rows and/or > 3 columns in the chi-square analysis reflect only the overall probability, not the individual pairwise breakdowns of those probabilities as the influence of these variables was examined again in more detail using logistic regression analysis, where the combined interaction between these variables and food insecurity was tested. Given the large sample size, and the relatively large number of tests being calculated, the authors chose the more conservative p-value of 0.010 to represent statistical significance. The students were not obliged to complete any of the items, and so some of the items reflect reduced numbers. Since most of the items were not of a psychometric nature, but were demographic, cases with missing items were not inputted, but were simply excluded from the analysis using those items.

Results

The age distribution was understandably very skewed, ranging from 18-86, but with a median of 21 years. The sample closely represented the general student population (Table II), with only some over-representation of undergraduates, compared to postgraduates. The single-item measure identified 65% of the students as food insecure. The more sensitive, multi-item measure identified food insecurity "without hunger" in 25%, and food insecurity "with hunger" in 59%, of the students.

Table II: The distribution of food insecurity prevalence across biographical attributes

The distribution of food insecurity prevalence across biographical attributes is summarised in Table II. Food insecurity was found to be associated with a number of demographic variables, including being an undergraduate, first-generation, black or coloured, male, single or unemployed student. When cross-tabulating the means of tuition payment with food insecurity, it was found that those who were studying while employed (representing 2% of the sample) experienced much lower food insecurity (46%) than those having to pay for their tuition from bursaries (61% food insecurity for merit bursaries, and 71% food insecurity for other bursaries) and loans (81% food insecurity), paying for themselves (66% food insecurity), or having the financial backing of family or benefactors (61% and 68% food insecurity, respectively). Employed students worked a mean of 19 hours/week, taking a mean of R3 343/month home from their jobs. Of the employed students, 28% reported that their jobs often interfered with their studies by reducing the time needed to perform academic work or to study. A further 34% reported that their jobs sometimes reduced their time to carry out academic work or studying, while 38% reported that having to work never impacted on their studies. More than a fifth of all of the students (22%, including 18% of the non-working students) indicated that they supported somebody else financially, mostly parents (7%), siblings (6%), children (4%) (23% reported having children), and partners or spouses (2%).

The distribution of food insecurity in relation to food procurement measures and attributes is outlined in Table III. Only 26% of the students reported that they always had enough money for food. The 7% who reported that they never had enough money for food were almost all food insecure. Food, or money for food, was obtained mostly directly (55%) or indirectly as an allowance (25%) from parents, relatives or guardians, whereas 27% paid for food from loans or bursaries, and 11% relied on salaries earned. Since the students could choose various options, cross-tabulation using chi-square analysis was repeated for each option (comparing food insecurity between those who did and did not select that option). Food insecurity was significantly greater in students who obtained their food money from parents, their allowance or their study loan. Most students reported that they prepared their own food, and these students were more likely to be food insecure than those whose meals were prepared by others. Only half of the students (50%) rated their own cooking skills as good. While most of the students (87%) reported that they seldom or never shared cooking duties with other students or friends, approximately 20% reported that they combined their money with other students or friends on a daily or regular basis to buy food. Most of the students reported that they borrowed money for food from friends (87%), relatives (16%) or parents (14%). More than 50% of them reported that they had asked someone else for food, 9% that they had had to sell some of their possessions to procure food money, and 2% that they had stolen food. Importantly, most of these students were also severely food insecure, i.e. "with hunger".

Given the number of significant predictors, the combined effect of these items on food security was tested. Table IV summarises the logistic regression model results pertaining to the biographical and food-related sets. The combined influence of the biographical items and various food-related (preparation and procurement) items were tested using a logistic regression model. On their own, these items seemed to demonstrate a relationship with food insecurity. It is noteworthy that whether the multiple-item or the single-item measure was used, with minor variations, the same items tended to be identified as significant predictors of food insecurity. Of the biographical items, the strongest predictors of food insecurity were race, being a first-generation student and gender. Several variables which related significantly to food insecurity on their own ceased to be significant when combined with other variables using logistic regression. Of the food-related items, a strong predictor of food insecurity was whether or not the students had enough money for food, as well as whether or not they had to ask others for food, or to sell their possessions in order to obtain food. In addition, although borrowing money for food was not a strong predictor of food insecurity in itself, borrowing money for food from parents (not their friends) was a strong predictor of food insecurity.

Table III: Food insecurity in relation to food procurement measures and attributes

Variable	n (%)	By multi-item measure			p-value	By single-item measure	
		Food secure	Food insecure "without hunger"	Food insecure "with hunger"		Food insecure	p-value*
		%	%	%		%	
Total students	1 394 (98.4)	15.4	24.6	60.0	< 0.001	64.5	0.001
Have enough money for food (n = 1364)							
Always	358 (26.3)	46.9	35.8	17.3	< 0.001	19.8	< 0.001
Sometimes (only part of the month)	607 (44.5)	4.9	25.2	69.9		76.0	
Often (only part of the month)	301 (22.1)	4.0	14.6	81.4		84.4	
Never	98 (7.2)	1.0	10.2	88.8		91.8	
Source of food or food money**							
From parents, relatives or a guardian							
Yes	771 (55.4)	19.6	24.8	55.6	< 0.001	61.9	0.027
No	620 (44.6)	10.3	24.5	65.2		67.6	
From an allowance							
Yes	349 (25.1)	18.6	24.6	56.7	0.150	56.7	< 0.001
No	1 041 (74.9)	14.4	24.6	61.0		67.1	
From a bursary (scholarship)							
Yes	236 (16.9)	12.3	30.1	57.6	0.063	67.0	0.382
No	1 157 (83.1)	16.1	23.5	60.4		64.0	
From a study loan							
Yes	140 (10.1)	5.0	23.6	71.4	< 0.001	75.0	0.006
No	1 252 (89.9)	16.6	24.8	58.6		63.3	
From his or her own salary							
Yes	154 (11.1)	24.7	20.8	54.6	0.003	57.1	0.044
No	1 239 (88.9)	14.3	25.1	60.6		65.4	
From charity							
Yes	10 (0.7)	10.0	0.0	90.0	0.123	90.0	0.091
No	1 384 (99.3)	15.5	24.8	59.8		64.3	
From a university food scheme							
Yes	11 (0.8)	0.0	18.2	81.8	0.249	72.7	0.567
No	1 383 (99.2)	15.6	24.7	59.8		64.4	
Usually prepare own food (n = 1 380)							
Yes	1 198 (86.8)	13.2	24.8	62.0	< 0.001	66.8	< 0.001
No	182 (13.2)	31.3	23.1	45.6		48.4	
Rating of own cooking skills (n = 1 385)							
Good	691 (49.9)	13.8	25.0	61.2	0.076	66.4	0.004
I can manage	564 (40.7)	17.9	25.4	56.7		60.5	
Not good	115 (8.3)	12.2	20.0	67.8		73.9	
I cannot cook at all	15 (1.1)	33.3	20.0	46.7		40.0	
Combine money with other students to buy food (n = 1 350)							
Daily	47 (3.5)	12.8	21.3	65.7	0.939	70.2	0.082
Regularly	218 (16.2)	15.1	25.7	59.2		57.8	
Seldom	382 (28.3)	15.5	26.4	58.1		62.3	
Never	703 (52.1)	15.9	23.9	60.2		66.4	
Have you ever borrowed money for food from someone else? (n = 1 356)							
No	397 (29.3)	41.3	34.3	24.4	0.001	26.7	0.001
Yes	959 (70.7)	5.1	20.5	74.4		79.4	

Variable	n (%)	By multi-item measure			p-value	By single-item measure	
		Food secure	Food insecure "without hunger"	Food insecure "with hunger"		Food insecure	p-value*
		%	%	%		%	
From parents							
Yes	126 (13.6)	11.9	31.0	57.1	0.001	63.5	0.001
No	798 (86.4)	3.8	18.2	78.1		84.0	
From relatives							
Yes	148 (16.1)	2.0	16.2	81.8	0.090	85.1	0.201
No	771 (83.9)	5.2	20.6	74.2		80.7	
From a spouse or partner							
Yes	62 (6.8)	4.8	19.8	75.5	0.781	83.9	0.658
No	849 (93.2)	4.8	16.1	79.0		81.6	
From friends							
Yes	836 (87.2)	4.4	19.3	76.3	0.011	82.2	0.000
No	123 (12.8)	9.8	24.4	65.9		69.1	
Have you ever resorted to?							
Asking someone else for food							
Yes	730 (52.5)	1.9	15.2	82.9	0.001	87.4	0.001
No	660 (47.5)	30.3	35.2	34.6		38.9	
Selling your possessions for food money							
Yes	131 (9.3)	0.8	5.4	93.8	0.001	97.7	0.001
No	1 283 (90.7)	17.5	26.7	55.8		61.1	
Stealing food							
Yes	22 (1.6)	0.0	4.6	95.5	0.002	90.9	0.009
No	1 372 (98.4)	15.7	24.9	59.4		64.1	

* p-value for the chi-square analysis of the cross-tabulation of all the categorical variables under a particular group heading ($p < 0.010$ was considered to be statistically significant)
** Students could choose more than one option

Biographical and food-related variables were combined in the final logistic regression model (Table V). The influence of gender and being a first-generation student was reduced considerably. Race was the only biographical variable which remained a strong predictor of food insecurity using the combined model, as well as having enough money for food, asking others for money for food, selling possessions to obtain food, or borrowing money from parents for food.

Discussion

In this study, it was found that food insecurity was not just more prevalent, but much more severe, at the University of the Free State, compared to tertiary institutions in the USA and Australia.[1,3-5] According to Maslow, individuals are "dominated by physiological needs",[20] such as the need for food, if these basic requirements are not satisfied. Maslow's theory implies that students may struggle to attend to academic achievement and fully respond to the demands of higher education when they are severely food insecure. However, it should be noted that Maslow provided examples of individuals who attended to the highest hierarchical needs while in the midst of great deprivation.[20] Therefore, the severity of the food insecurity found in the current study population is relevant to South Africa. Academic institution personnel endeavour to address racial inequality in graduates in the aftermath of apartheid by enrolling more students from disadvantaged backgrounds into higher education. However, they are currently challenged by a 50% dropout rate.[13,14] The level of food insecurity found in the sample was only marginally higher than that in the surrounding population. However, university students are considered to be "privileged" and the level of food insecurity in university students is not expected to be the same as that in the unemployed population. Furthermore, upon graduation, these students are expected to become productive members of society. However, society will experience long-term consequences if food insecurity is impacting on the ability of students to study and graduate.

Over the last 20 years, the South African government's National Student Financial Aid Scheme has been instrumental in increasing higher education enrolment rates of black and coloured students from disadvantaged backgrounds.[13,17] However, higher education remains unattainable for many as there are insufficient available funds for all of the students who apply and are deemed eligible.[18] Students from poor backgrounds who manage to secure financial aid face significant challenges adapting to higher education compared to their peers from well resourced backgrounds.[15] The

Table IV: Logistic regression results: biographical and food-related sets

Parameter	df	By multi-item measure				By single-item measure			
		Estimate	SE	Wald chi-square test	p-value	Estimate	SE	Wald-chi-square test	p-value
Analysis 1: Biographical items									
Intercept *Multi-item: Food insecure with hunger* *Single item: Food ran out*	1	2.21	0.50	19.63	< 0.001	–2.62	0.55	22.98	< 0.001
Intercept *Multi-item: Food insecure without hunger*	1	3.69	0.51	53.22	< 0.001				
Gender	1	–0.37	0.12	9.06	0.003	0.41	0.13	9.39	0.002
Race	1	–0.92	0.09	117.25	< 0.001	0.94	0.10	92.74	< 0.001
Relationship status	1	–0.10	0.09	1.19	0.275	0.19	0.11	3.12	0.078
Study level	1	–0.39	0.19	4.17	0.041	0.39	0.21	3.52	0.061
First-generation student	1	0.61	0.12	27.39	< 0.001	–0.57	0.13	20.38	< 0.001
Employed	1	0.18	0.17	1.13	0.288	–0.21	0.19	1.33	0.249
Analysis 2: Food-related items									
Intercept *Multi-item: Food insecure with hunger* *Single item: Food ran out*	1	1.42	1.46	0.94	0.331	–13.63	596.70	0.00	0.982
Intercept *Multi-item: Food insecure without hunger*	1	3.67	1.48	6.17	0.013				
Prepare own food	1	–0.27	0.26	1.04	0.309	0.53	0.29	3.49	0.062
Enough food money	1	1.10	0.14	65.87	< 0.001	–0.91	0.15	38.29	< 0.001
Borrowed food money	1	–2.87	1.31	4.78	0.029	14.14	596.70	0.00	0.981
Borrowed food money from parents	1	–0.75	0.25	8.72	0.003	0.77	0.28	7.57	0.006
Borrowed food money from friends	1	–0.38	0.27	1.88	0.170	0.21	0.30	0.47	0.492
Asked others for food	1	1.28	0.19	45.13	< 0.001	–1.33	0.21	40.01	< 0.001
Sold possessions for food	1	1.52	0.44	12.19	0.001	–2.45	0.74	11.12	0.001
Stole food	1	1.11	1.09	1.05	0.307	0.31	0.84	0.14	0.710

df: degree of freedom, SE: standard error

financial struggle which these students experience contributes significantly to the high attrition rates experienced at South African universities, particularly those in undergraduate programmes.[16,21] It was reported in 2009 that the government financial aid packages in South Africa were not adequate to fund study fees, accommodation and food.[22] The results of the current study support this conclusion as first-generation students, black and coloured students, males, undergraduates and those relying on financial aid were most likely to be food insecure.

When combining the biographical variables using a logistical regression model, race, gender and being a first-generation student still emerged as significant predictors of food insecurity. When combining the biographical items with those relating to having money for food using another logistic regression model, race remained one of the strongest predictors of food insecurity. Most students, even those on financial aid, indicated that they relied directly or indirectly on parents or relatives for food, or money for food, underscoring the financial burden which is placed on their families by keeping them in higher education.

Some students reported that they sought employment to cope with the financial pressure. However, similar to the findings of an Australian university,[1] these students claimed that being employed interfered with their ability to tend to their academic work. Many students in the current study population supported others financially,

Table V: Logistic regression results: combined item sets

Parameter	df	By multi-item measure				By single-item measure			
		Estimate	SE	Wald chi-square test	p-value	Estimate	SE	Wald chi-square test	p-value
Intercept *Multi-item: Food insecure with hunger Single item: Food ran out*	1	16.00	546.50	0.00	0.977	–13.3	697.5	0.0	0.985
Intercept *Multi-item: Food insecure without hunger*	1	18.29	546.50	0.00	0.973				
Gender	1	–0.39	0.20	3.67	0.055	0.2	0.2	0.8	0.386
Race	1	–0.50	0.14	13.37	0.003	0.3	0.2	4.4	0.036
Relationship status	1	–0.09	0.17	0.27	0.601	0.1	0.2	0.6	0.442
Study level	1	–0.21	0.34	0.37	0.543	–0.4	0.4	1.1	0.298
First-generation student	1	0.17	0.19	0.82	0.364	–0.1	0.2	0.4	0.521
Employed	1	–0.64	0.32	3.97	0.046	0.0	0.3	0.0	0.903
Prepare own food	1	–0.28	0.27	1.04	0.308	0.5	0.3	3.1	0.079
Enough food money	1	1.05	0.14	56.78	< 0.001	–0.9	0.2	32.2	< 0.001
Borrowed food money	1	–14.61	546.50	0.00	0.979	13.4	697.5	0.0	0.985
Borrowed food money from parents	1	–0.58	0.27	4.58	0.032	0.7	0.3	5.6	0.018
Borrowed food money from friends	1	–0.36	0.28	1.63	0.202	0.2	0.3	0.6	0.446
Asked others for food	1	1.20	0.20	35.01	< 0.001	–1.3	0.2	33.4	< 0.001
Sold possessions for food	1	1.45	0.46	9.80	0.002	–2.4	0.7	10.4	0.001
Stole food	1	0.88	1.10	0.64	0.422	0.3	0.9	0.1	0.701

df: degree of freedom, SE: standard error

including children, siblings and parents. These students were more likely to be food insecure than those who did not. Yet, those who supported others were not necessarily employed, raising the possibility that loans or bursaries were used to help support family members. Indeed, it was found in a recent study at the University of KwaZulu-Natal that 20% of underperforming first-year students regularly sent remittances diverted from their loans or bursaries home, leaving very little on which to survive.[23]

The impact of financial pressure on food procurement was evident from the findings of this study. Three quarters of the students reported not always having enough money for food. This remained the strongest indicator of food insecurity after combining all of the variables in a logistical regression model. Students reported coping by borrowing money for food (mostly from each other, rather than from their parents), or by a number of students contributing money to a pool, and then buying food together. More severe coping strategies included selling their possessions, or even stealing food. Similar coping strategies were also recently reported by students at the University of the Witwatersrand in Johannesburg.[24] Unsurprisingly, these coping mechanisms were associated with severe food insecurity in the current study population. According to the logistic regression models, coping mechanisms that were strong predictors of food insecurity were having borrowed money for food from parents, having asked others for food, and having sold possessions to obtain food money.

However, food security is not only dependent on economic factors.[8,9] Students at the University of the Witwatersrand survey[25] reported that besides depleting their funds and going without food, they also experienced problems acquiring food on campus. It was found in the latter survey that basic, but critically important food services, highly valued by students, were offered by residence catering services.[24] Within the last two decades, many South African universities, including the University of the Free State, have abandoned the catering model, or even abandoned food halls attached to residences altogether, in a bid to make higher education more affordable. Unlike the situation many decades ago, most South African students, including those at the University of the Free State, now live off campus, and often share student houses, flats or townhouses with other students.

The prevalence of food insecurity in the current survey was lowest in students living with their parents or relatives, whereas it was highest in unmarried students and those sharing housing with other students, although these attributes were not significantly associated with food insecurity after applying the combined regression models. The high prevalence of food insecurity in these groups may reflect the impact on students of not having someone else to take the responsibility of procuring food and cooking meals. Most students in the current study population prepared their own food, but half of them were unconfident about their own cooking skills. Having catered food services on campus offering balanced meals or ready-to-go healthy food options could address some of the underlying problems relating to students' food insecurity. Restructuring financial aid in such a way that students have access to these meals in some way other than having to buy them on a daily basis might also address the problem of students feeling obliged to send financial aid money home to support their families.

Food was reported in previous surveys at the University of the Free State (unpublished data, 2010-2013), as well as in the Wits survey, to be expensive on campus, forcing students to acquire food elsewhere.[24] Convenience is a primary food motivation for students.[24] Thus, convenience, combined with the struggle to find affordable and nutritious food on campus, caused students to rely on cheap, energy-dense foods with low nutritional value which fill them up, but leave them vulnerable to nutrition-related diseases.[23,25] In addition, deficiencies in general nutrition knowledge by South African students has been reported in studies,[26,27] while other surveys specifically identified lack of food shopping skills[23] and financial management ability in food-insecure students in South Africa.[23]

Limitations

This was an online, self-reported survey. Thus, generalisation of the findings may be affected as uncertainty about the identities of exactly who completed the questionnaires could exist. However, only students with valid student numbers could gain access to the survey and complete it once. Furthermore, the subjective nature of food security indices which are based on self-reported questionnaires needs to highlighted. This was illustrated in Table II, for example. Of the students who reported that they always had enough money for food, only 47% were food secure according to the multi-item measure, and 17% were food insecure "with hunger"; while according to the single-item measure, 20% were classified as food insecure.

Although only 5% of the 2013 student population submitted the questionnaire, the sample represented that population well in general (Table II). Since reliable information was not gathered by the university on the sources and amount of income given to the students by their parents or as loans, it was impossible to determine whether or not the sample was fully representative of the student population socio-economically. Thus, poorer students were more likely to complete the survey. This cannot be proved or disproved without a second study being conducted on the income and financial status of students in general, and is probably a limitation of all such similar studies reported in the literature. Students across the board were motivated to participate in the study by means of the following statement in the advertisement or information document on the study: "We would greatly appreciate it if you would please consider taking part in this survey as to whether or not you feel that you have any problem regarding food security, and to answer all of the questions as honestly as possible, because it is only with the help of students across the board that the university may get a clear picture of the scope of the problem". In addition, three cash prizes were offered in a lucky draw, using the student numbers, with the hope that this would motivate students of all income levels to participate in the study. The names of the prize winners were kept confidential for ethical reasons.

Conclusion and recommendations

This study contributes to an understanding of food insecurity in students in higher education, and the associated challenges in a developing country with high national food insecurity at household level. The ideals of higher education, i.e. higher education representing an opportunity through which individuals can escape poverty, are defeated if large numbers of students are going hungry, and threatens the country's investment in human capital. The revision of governmental financial aid packages, as well as the establishment and expansion of food aid campaigns at higher education institutions, with financial involvement from non-governmental organisations and the private sector, may alleviate some of the pressure of food insecurity on students. However, policies and interventions are also needed to ensure that nutritious food is affordable and available in a convenient way on campus. The feasibility of reintroducing dining rooms or canteens with catering services which offer affordable, nutritious complete meals to both campus residents and commuters, should be investigated. Students also need to be empowered with knowledge of nutrition, and the basic skills to procure and prepare nutritious meals using the facilities that they have. This is important, not just to survive at university, but also as an investment in their future health. Dietitians and nutritionists can, and should, play a key role, by initiating and guiding initiatives, for example food gardens and web-based demonstrations on how to plan a healthy diet, and how to prepare quick, affordable nutritious meals. The urgent involvement of all stakeholders is required if effective and sustainable solutions are to be found to the food insecurity crisis emerging in higher education in South Africa.

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