

# Food insecurity prevalence among college students at the University of Hawai'i at Mānoa

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Submitted 2 May 2008: Accepted 29 May 2009: First published online 4 August 2009

## Abstract

*Objectives:* To assess the prevalence and identify possible predictors of food insecurity among college students at the University of Hawai'i at Mānoa.

*Design:* Cross-sectional survey, including the US Department of Agriculture's Household Food Security Survey Module, demographic and spending variables.

*Setting:* University of Hawai'i at Mānoa, Honolulu, Hawai'i (USA).

*Subjects:* Four hundred and forty-one non-freshmen students from thirty-one randomly selected classes.

*Results:* Twenty-one per cent of students surveyed were food-insecure, while 24% were at risk of food insecurity. Students at higher risk of food insecurity included those who reported living on campus and those living off-campus with room mates. Those identifying themselves as Hawaiians and Pacific Islanders, Filipinos and mixed were also at increased risk of food insecurity.

*Conclusions:* Food insecurity is a significant problem among college students at the University of Hawai'i at Mānoa. Food availability and accessibility should be increased for these students through the establishment of on-campus food banks and student gardens. Future studies should assess the prevalence of food insecurity in other college campuses nationwide.

**Keywords**  
Food insecurity  
College students  
Hawai'i

Food insecurity 'exists when there is limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways'<sup>(1)</sup>. Food insecurity, under this definition, is a condition resulting from financial resource constraints, including geographical differences in the cost of food and housing<sup>(2)</sup>. There are other factors that can also impact food insecurity status; for example, a lack of skills in managing money and food (e.g. preparing budgets, managing bills, stretching groceries at the end of the month)<sup>(3)</sup>.

In 2006, 12.6 million US households (10.9% of all households surveyed) were found to be food-insecure<sup>(4)</sup>. In Hawai'i, the prevalence of food insecurity was substantially lower, with 7.8% of all Hawai'i households estimated to be food insecure in 2004–6<sup>(4)</sup>. Similar to national findings<sup>(4)</sup>, data collected in Hawai'i indicate that a higher prevalence of food insecurity occurred in households with children and in households with lower income relative to the poverty line<sup>(5)</sup>. Hawaiians and Pacific Islanders were at highest risk of food insecurity, followed by Filipinos<sup>(5)</sup>. The islands of Molokai, Lanai and Maui had the highest levels of food insecurity, while

Oahu had the lowest. However, all islands had high levels of food insecurity in certain geographical areas<sup>(5)</sup>.

Results from multiple studies indicate that food insecurity may have a negative impact on academic outcomes among children of various age groups<sup>(6–10)</sup>. Food insecurity, hunger or food insufficiency were associated with behavioural and attention problems<sup>(6)</sup>, absenteeism and tardiness<sup>(6,7)</sup>, psychosocial dysfunction<sup>(6,7)</sup>, low maths<sup>(8,9)</sup> and reading scores<sup>(10)</sup>, grade repetition<sup>(8)</sup> and being suspended from school<sup>(8)</sup> in several different samples of children and adolescents across the USA. Studies analysing the association between food insecurity and poor academic performance, to our knowledge, have never been conducted among college students. In fact, there is very limited information on the extent, determinants or consequences of food insecurity in college populations. Given the potential correlation between reduced scholastic achievement and food insecurity, it is important to investigate how prevalent food insecurity is among college students. It is also important to determine which students, if any, are at increased risk of suffering from food insecurity.

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To our knowledge, only two unpublished undergraduate research projects have measured the prevalence of food insecurity in a university campus setting. These two studies were conducted at Ohio University (D Holben, personal communication, 11 October 2005) and at the University of Hawai'i at Mānoa (UHM; SS Zaghoul, unpublished results). The study carried out in Hawai'i was done as a pilot study conducted among students taking an introductory nutrition course and found that 22% of the students surveyed were food-insecure, while 14.5% were at risk of food insecurity (SS Zaghoul, unpublished results). The prevalence of food insecurity among these students was thus twice as high as the US average for the year 2006 (10.9%) and almost three times higher than the average for Hawai'i for the years 2004–6 (7.8%)<sup>(4)</sup>. While the sample size of that study was small and not representative of the entire student body, the results suggested possible elevated food insecurity among UHM students and served as motivation for the present research.

The objectives of the present study were: (i) to assess the prevalence of food insecurity among students at UHM; and (ii) to identify possible predictors of food insecurity among this population.

## Methods

The study was approved by the University of Hawai'i Committee on Human Subjects. Data were collected from students at UHM during October and November 2006 using a survey designed to measure food insecurity and its potential predictors and consequences in this population. Only prevalence, demographic characteristics and spending patterns of the food-insecure UHM students are included herein. Because the food security questions inquired about food security status during the previous year, freshmen were excluded from the study to ensure that results reflected college life experience.

Courses were randomly selected from a list of all courses offered during autumn 2006. This list was stratified by four course levels with typical enrolment by sophomores, juniors, seniors and graduate students. Classes were chosen randomly within each stratum, oversampling graduate courses to offset the smaller average size of graduate classes. We emailed instructors of the ninety-five randomly selected courses requesting 15 min of one class period to distribute the informed consent form and the questionnaire. Thirty-one (33%) of the ninety-five instructors queried agreed to participate in the study. Forty-four (46%) of contacted instructors did not reply after two contact attempts and therefore their classes were dropped from the study. Twenty instructors (21%) declined to participate in the study, with 75% of these instructors indicating limited class time as the reason. From the thirty-one participating classes, 441 of 445 students present agreed to complete the survey.

Exclusion criteria included being a freshman ( $n$  3) or an unclassified student ( $n$  5), being on a special diet because of illness ( $n$  8), being pregnant ( $n$  1) and not completing the food security core questions ( $n$  14). Thus, a total of thirty-one participants were excluded, resulting in a sample of 410 valid surveys.

## Survey instrument

The survey included questions on food security, demographics and spending patterns. To assess clarity and applicability of questions to college-age students, a small pilot test was conducted using a convenience sample of nine UHM students from different majors and academic years. Students were asked to fill out the questionnaire independently and then as a group to openly discuss all of the questions. Each question was assessed for readability and relevance to the college population. The session was audio-taped to ensure that the comments of the students were captured correctly. Suggestions and clarifications were included in the final questionnaire.

## Food security

The US Adult Food Security Survey Module (AFSSM), which is a subset of the US Household Food Security Survey Module (HFSSM), was used to measure food security status<sup>(11)</sup>. The AFSSM consists of ten questions; each question addressed conditions and behaviours that may have occurred in the previous 12 months and that attempt to characterize households with difficulty meeting basic food needs. The questions specify lack of money or other resources to obtain food as a reason; therefore, voluntary fasting and/or dieting to lose weight were excluded from the measure<sup>(2)</sup>. AFSSM results were summarized by summing positive responses and collapsing the results into four food security categories (high food security, marginal food security, low food security, very low food security), as shown in Table 1<sup>(12)</sup>. The HFSSM, from which the AFSSM is derived, has been found to be valid and reliable for Asians and Pacific Islanders living in Hawai'i<sup>(13)</sup>.

## Social determinants

Demographic data obtained included age, gender, marital status, number of children, ethnicity, major, academic year (i.e. sophomore, junior, etc.), living arrangement, participation in a campus meal plan, place of birth, length of residency in Hawai'i and food programme participation.

## Students' spending patterns

Students were asked to report approximate expenditures in each of several categories during an average month. These categories included housing, transportation, food (groceries and eating out), entertainment, cell phone and shopping for other items (e.g. clothes, shoes, household items). Respondents selected amounts from supplied ranges. Additionally, respondents were asked to indicate

**Table 1** Food security categories based on the number of affirmative responses to the US Adult Food Security Survey Module

Affirmative responses	Food security category	Food security status	Household conditions
0	High food security	Food-secure	No food access problems
1–2	Marginal food security		Anxiety over household food shortage
3–5	Low food security	Food-insecure	Reduced diet quality, variety and appeal
>5	Very low food security		Reduced food intake and disrupted eating patterns

Adapted from Nord<sup>(12)</sup>.

any large expense (tuition, schoolbooks, travel, etc.) in the past year, and how much money they have available to spend each month.

### Statistical analyses

Descriptive statistics were used to summarize the prevalence of food insecurity and the characteristics of the sample. Differences between food-secure and food-insecure individuals were analysed using  $\chi^2$  tests, *t* tests and linear-by-linear association analyses, with significance specified as  $P < 0.05$ . Because small sample sizes rendered asymptotic assumptions questionable when data were analysed using the four food security category outcome, we dichotomized the dependent variable into food security (high food security + marginal food security) and food insecurity (low food security + very low food security). The SPSS<sup>®</sup> statistical software package version 15.0 (SPSS Inc., Chicago, IL, USA) was used for all data analyses.

Multivariate logistic regression models were used to examine the effect of different variables on food insecurity, while adjusting for gender, marital status and having children. Variables indicated to be significant in univariate analysis were included in the multivariate model and include living arrangement, ethnicity, years of residency in Hawai'i, and expenditures on transportation, eating out, entertainment and shopping. We also included place of birth, as it was associated with the four-level outcome of food insecurity in a univariate model.

### Results

The prevalence of food insecurity among UHM students surveyed was 21% ( $n = 85$ ), with 15% ( $n = 61$ ) having low food security and 6% ( $n = 24$ ) very low food security. Approximately one in four students (24%;  $n = 98$ ) reported having one or two indicators of food insecurity, classifying them as marginally food-secure or at risk of food insecurity.

Table 2 shows the demographic characteristics of the sample by food security status. Living arrangement and ethnicity were significantly different between food-secure and food-insecure groups. Years of residency in Hawai'i was also significantly different between food-secure and food-insecure students (food-secure, mean 14.8 (SD 10.9) years; food-insecure, mean 10.8 (SD 10.5) years;  $t = 3.04$ ,

$P = 0.003$ , data not shown). The average age for both food-secure and food-insecure students was 26 years (food secure, SD = 7 years; food-insecure, SD = 6 years).

The distribution of the students' monthly spending patterns is shown in Table 3. Money spent on housing, groceries, cell phone and one-time large expense did not differ significantly between the food-secure and food-insecure. However, the probability of food insecurity increased significantly as expenditures on transportation, eating out, entertainment and shopping increased.

Results from the multivariate model suggest that students who lived on campus, who lived off-campus but did not specify their living arrangement (off-campus unknown) or who lived off-campus with room mates were more likely to be food-insecure than were students living with their parents or relatives (OR = 2.98, 4.96 and 5.01, respectively; Table 4). Ethnic differences were also observed. Japanese have been previously reported as the most food-secure in Hawai'i<sup>(5)</sup>. When compared with Japanese, Hawaiians and Pacific Islanders, Filipinos, and students reporting two or more ethnicities had significantly higher odds of being food-insecure (Table 4). Additionally, years lived in Hawai'i was a significant predictor of food insecurity: an additional year of residency reported was estimated to decrease the odds of food insecurity by 5.8% (OR = 0.942; Table 4).

### Discussion

Forty-five per cent of UHM students surveyed were either food-insecure or at risk of being food insecure. The prevalence of food insecurity among UHM students (21%) was nearly three times that reported by the US Department of Agriculture (USDA) for the state of Hawai'i for the years 2004–6 (7.8%)<sup>(4)</sup>. Food insecurity on campus was also slightly higher than the prevalence found among Hawaiian residents reported by the Hawai'i Health Survey (HHS) of 1999–2000 (16.5%)<sup>(5)</sup>. The USDA study used the HFSSM to measure food insecurity<sup>(4)</sup> and the present study used a subscale of such survey, the AFSSM. The HHS, however, used a six-question food security questionnaire (previously validated against the HFSSM) and thus a different coding system<sup>(5)</sup>, suggesting it is more appropriate to compare our findings with the USDA results. Our prevalence estimates are similar to results of the pilot study conducted previously at UHM during

**Table 2** Distribution of demographic characteristics by food security status\*: college students at the University of Hawai'i at Mānoa, October/November 2006

Demographic characteristic	Food-secure (%)	Food-insecure (%)	<i>P</i> value†
Gender			0.080
Female ( <i>n</i> 231)	82	18	
Male ( <i>n</i> 177)	75	25	
Marital status			0.312
Single ( <i>n</i> 351)	78	22	
Married ( <i>n</i> 57)	84	16	
Children			0.906
Yes ( <i>n</i> 42)	79	21	
No ( <i>n</i> 368)	79	21	
Level of education			0.174
Undergraduate ( <i>n</i> 247)	77	23	
Graduate ( <i>n</i> 147)	82	18	
Living arrangement			<0.001
On campus ( <i>n</i> 50)	62	38	
Off-campus unknown ( <i>n</i> 47)	72	28	
Off-campus alone ( <i>n</i> 42)	83	17	
Off-campus with parents ( <i>n</i> 124)	89	11	
Off-campus with room mates ( <i>n</i> 71)	69	31	
Off-campus with spouse ( <i>n</i> 76)	87	13	
On school meal plan			0.388
Yes ( <i>n</i> 29)	72	28	
No ( <i>n</i> 366)	79	21	
Place of birth			0.183
Hawai'i ( <i>n</i> 169)	83	17	
Mainland USA ( <i>n</i> 115)	74	26	
Another country ( <i>n</i> 116)	80	20	
Ethnicity			0.004
Chinese ( <i>n</i> 44)	84	16	
Filipino ( <i>n</i> 42)	67	33	
Hawaiians and Pacific Islanders ( <i>n</i> 37)	62	38	
Japanese ( <i>n</i> 77)	92	8	
Korean ( <i>n</i> 15)	87	13	
White ( <i>n</i> 105)	76	24	
Two or more ethnicities ( <i>n</i> 49)	76	24	
Other ( <i>n</i> 34)	85	15	
Participation in food assistance programmes			‡
Emergency food from church, food pantry/bank or emergency kitchen ( <i>n</i> 9)	44	56	
WIC ( <i>n</i> 8)	63	37	
Food stamps ( <i>n</i> 8)	50	50	
Private organization ( <i>n</i> 3)	33	67	

WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

\*Total number of valid surveys = 410. Numbers may vary because of missing data.

† $P < 0.05$  is statistically significant.

‡Data not analysed due to small sample size in each cell.

spring 2005 (SS Zaghoul, unpublished results); the prevalence of food insecurity is almost the same in both studies (21–22%). However, the prevalence of marginally food-secure students found in the current study was somewhat higher than that found in the pilot study (21% *v.* 14.5%).

In the present study, students living on campus, off-campus with unknown arrangement and off-campus with room mates were significantly more likely to be food-insecure than were students living with their parents or relatives. Because we are unaware of any other published study examining food security in a college campus setting, comparison of these results with others in similar settings is difficult. Noting that high housing costs have previously been associated with food insecurity<sup>(14)</sup> and that Honolulu was recently ranked the third most expensive city in the nation<sup>(15)</sup>, it is likely that students living with their parents, relatives and spouses spend substantially less on housing

than students in other living arrangements and hence are less likely to be food-insecure.

There was disparity in food insecurity between Japanese and other ethnic groups. Hawaiians and Pacific Islanders, Filipinos, and students with multiple ethnicities were more likely to be food-insecure than Japanese students, after controlling for gender, having children and marital status. Similar findings were found in the HHS<sup>(5)</sup>, as well as in another local survey<sup>(13)</sup>. Additionally, the Hawai'i Food Bank reports that the largest ethnic group it serves (33%) is Native Hawaiian or other Pacific Islanders<sup>(16)</sup>. Among students surveyed in the present study, being Hawaiian or Pacific Islander was the most significant predictor of food insecurity, with Hawaiian and Pacific Islander students estimated to have almost thirteen times greater odds of being food-insecure compared with Japanese students. These results mirror state poverty rates where 16% of all Native Hawaiians lived below

**Table 3** Distribution of monthly spending patterns (\$US) by food security status: college students at the University of Hawai'i at Mānoa, October/November 2006

Spending variable	Food-secure		Food-insecure		P value*
	n	%	n	%	
Housing					0.082
\$0–500	170	54	49	60	
\$501–750	71	22	20	25	
\$751–1000	28	9	7	9	
>\$1000	47	15	5	6	
Transportation					0.003
\$0–50	109	34	42	51	
\$51–100	86	27	20	24	
\$101–150	40	13	9	11	
\$151–200	29	9	5	6	
>\$200	52	16	6	7	
Groceries					0.646
\$0–50	74	24	16	20	
\$51–100	73	23	27	33	
\$101–150	64	20	16	20	
\$151–200	44	14	9	11	
>\$200	59	19	14	17	
Eating out					0.004
\$0–50	72	25	25	36	
\$51–100	86	30	27	39	
\$101–150	67	24	12	17	
\$151–200	25	9	3	4	
>\$200	34	12	3	4	
Entertainment					0.004
\$0–50	152	48	54	66	
\$51–100	96	30	16	20	
\$101–150	35	11	11	13	
\$151–200	21	7	0	0	
>\$200	13	4	1	1	
Cell phone					0.779
\$0–30	133	42	32	40	
\$31–60	113	36	28	35	
\$61–90	40	13	14	18	
\$91–120	24	8	4	5	
>\$120	6	2	2	3	
Shopping					0.008
\$0–50	125	39	44	54	
\$51–100	97	31	23	28	
\$101–150	47	15	7	9	
\$151–200	22	7	3	4	
>\$200	26	8	4	5	
One-time large expenset					0.057
\$0–350	33	10	15	19	
\$351–500	52	16	14	17	
\$501–750	54	17	12	15	
\$751–1000	41	13	13	16	
>\$1000	139	44	27	33	

\*Linear-by-linear association test,  $P < 0.05$  is statistically significant.

†One-time large expense in the past year (e.g. tuition, school books, travel, etc.).

the poverty line in 1999 compared with only 6% of Japanese<sup>(17)</sup>.

Number of years in Hawai'i was negatively associated with food insecurity in the multivariate analysis. A previous study also found that time lived in the USA was significantly and negatively associated with food insecurity among West African refugees<sup>(18)</sup>.

While we anticipated money management skills might affect food insecurity among this student population, significant differences in expenditures measured were not observed between food-secure and food-insecure groups

in the multivariate analysis. Lack of an association may be due to limitations in the scope of our survey questions on this topic in an effort to keep the survey instrument brief. Similarly, differences may have been obscured because we did not attempt to collect information on credit card use or assess students' debt. Studies have shown that it is common for college students to utilize credit cards and to have significant debt<sup>(19–21)</sup>; it is plausible that food-insecure students in our sample may be incurring debt to assist in supporting themselves through college.

Very few students in our sample participated in food assistance programmes, quite likely because most college students are not eligible for programmes such as food stamps<sup>(22)</sup>. Students may therefore suffer from food insecurity with little opportunity for public assistance.

Because of the diverse population composition of Hawai'i students and because of high living expenses in Hawai'i, the results of the present study should not be generalized to other college students in the USA. However, our results suggest that food insecurity may exist on other college campuses, although likely with different prevalence and possibly with different explanatory factors.

**Limitations**

While virtually all students in participating classes completed the survey, only 33% of invited instructors permitted the survey to be distributed in their classes, a potential source of selection bias. We suggest any such bias may be minor, as our sample still included classes from virtually all colleges at UHM. Classes within each class-level stratum were not selected proportional to class size, and thus students only in large classes were possibly less likely to be included. However, our sample did include numerous students from both large and small classes, and furthermore we suggest it unlikely an association exists between food insecurity and the size of class an individual attends.

Income is a known contributing factor to food insecurity, yet we were unable to collect specific relevant income information and thus it is difficult to determine the contribution of income variation on food insecurity among UHM students. Assessing income in this population is difficult given the variety of support students are likely to receive from relatives, such as living with their parents or other relatives, or housing paid for or augmented by parents. In recognition of this variation, we instead assessed students' spending patterns, which while somewhat less difficult is still an imperfect measure of purchasing power. In addition, credit card use/debt and levels of other debt were not determined.

**Conclusions**

Food insecurity is a significant problem for one in every five students surveyed at UHM. A need exists to increase

**Table 4** Multivariate logistic model predicting the likelihood of being food-insecure by demographic factors and spending patterns\*: college students at the University of Hawai'i at Mānoa, October/November 2006

Outcome variable	<i>B</i>	OR†	95 % CI	<i>P</i> value‡
Intercept	-1.733	0.177		0.145
Living arrangement				
On campus	1.093	2.983	1.015, 8.773	0.047
Off-campus unknown	1.601	4.960	1.460, 16.846	0.010
Off-campus alone	1.090	2.973	0.795, 11.121	0.105
Off-campus with room mates	1.612	5.011	1.684, 14.915	0.004
Off-campus with spouse	0.566	1.761	0.484, 6.406	0.390
Off-campus with parents	0§	1.000		
Place of birth				
Mainland USA	-0.489	0.614	0.171, 2.199	0.453
Another country	-1.193	0.303	0.081, 1.131	0.076
Hawai'i	0§	1.000		
Years of residency in Hawai'i	-0.060	0.942	0.888, 0.999	0.046
Ethnicity				
Chinese	1.322	3.749	0.819, 17.160	0.088
Filipino	2.147	8.558	2.120, 34.546	0.003
Hawaiians and Pacific Islanders	2.546	12.754	3.006, 54.104	0.001
Korean	0.867	2.381	0.304, 18.618	0.408
White	0.824	2.279	0.566, 9.175	0.246
Two or more ethnicities	1.555	4.736	1.247, 17.979	0.022
Other	0.500	1.649	0.307, 8.859	0.559
Japanese	0§	1.000		
Spending patterns				
Transportation	-0.461	0.631	0.368, 1.081	0.094
Eating out	-0.498	0.608	0.318, 1.163	0.132
Entertainment	-0.168	0.846	0.370, 1.934	0.691
Shopping	-0.071	0.931	0.492, 1.764	0.827
Gender				
Male	0.514	1.671	0.885, 3.157	0.113
Female	0§	1.000		
Marital status				
Single	0.212	1.236	0.348, 4.397	0.743
Married	0§	1.000		
Children				
Yes	0.951	2.588	0.694, 9.649	0.157
No	0§	1.000		

\*Total sample = 313.

†Adjusted for gender, marital status and having children.

‡*P* < 0.05 is statistically significant.

§Set to zero because this parameter is redundant (reference category).

food availability and accessibility on campus through establishing on-campus food banks and student gardens. Future studies need to investigate the impact of food insecurity on college students' academic performance and the strategies these students use to cope with their food insecurity. Additionally, an investigation of the prevalence of food insecurity on other college campuses would enable assessment of food insecurity across a variety of college student demographics. Identification of food insecurity and its determinants among college students across the nation can enable policy makers to both assess the magnitude of the problem and to formulate effective strategies to reduce its prevalence.

### Acknowledgements

The study was funded by the Department of Human Nutrition, Food and Animal Sciences at the University of Hawai'i at Mānoa. The authors have no conflict of interest

to report. All authors participated in the design of the study; M.P.C., S.S.Z. and J.D. participated in the development of the survey and informed consent; M.P.C., S.S.Z. and P.H. participated in all data analysis; and M.P.C. participated in the data collection and management. We would like to thank the instructors and students who participated in the study.

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