Food insecurity during COVID-19: An Australian university experience

Christie Jane Bennett BNutDiet(Hons), PhD1  |  Meaghan Christian BAppSci/BSocSci, MScNut, PhD1  |  Shirley Phan BNutDiet(Hons)2  |  Melinda McCabe BPsys(Hons)3  |  Kim Cornish BSc(Hons)Psychology, PhD3  |  Sue Kleve BSc(Hons), BND, PhD1

1Department of Nutrition, Dietetics and Food, School of Clinical Sciences, Monash University, Melbourne, Victoria, Australia  
2Buildings and Property Division, Monash University, Clayton, Victoria, Australia  
3School of Psychological Sciences, Turner Institute for Brain and Mental Health, Monash University, Clayton, Victoria, Australia

Correspondence  
Sue Kleve, Level 1, 264 Ferntree Gully Road, Notting Hill, Victoria 3168, Australia.  
Email: suzanne.kleve@monash.edu

Funding information  
University of Otago

Abstract  
The aim of this study was to describe the prevalence, severity, coping strategies and precipitating factors of food insecurity in university students in a large multi-campus Australian university during the COVID-19 lockdown in 2020, in context of providing information to inform institutional support. This was a cross-sectional analysis which was part of a larger university-led research project, the Thrive@Home study conducted at Monash University during the COVID-19 pandemic. The main outcome measures included: Sociodemographic characteristics, PROMIS anxiety, PROMIS depression and the six-item US Department of Agriculture Household Food Security Survey Module. All variables were reported according to the four levels of food security status (high (H), marginal (M), low (L) and very low (VL)). Chi-squared tests were used to compare all categorical variables including demographic, mental health and food security status. A multivariable regression was conducted between food security status and mental health variables. Overall, n = 1315 students were included in the analysis. Of which, 5% were classified as having VL food security, 13% L, 14% M and 68% H. As food security worsened the likelihood of being unemployed looking for work, living alone and deteriorating physical health, diet quality and mental health increased. As food security status deteriorated the prevalence of needing to ask family or friends for food, shopping at multiple outlets for discounts, accessing emergency food relief, subsidised meals and financial assistance from organisations increased (p < 0.002). In regression models adjusting for covariates, depression (b (95%CI): VL = 7.2(4.1–10.3), L = 3.7(1.7–5.7), M = 2.0(0.1–3.8)) and anxiety (VL = 7.4(4.5–10.4), L = 3.5(1.5–5.4) and M = 2.0(0.3–3.8)) were positively associated with worsening food security. Food insecurity during COVID-19 was associated with worsening mental health. This paper provides targets for future university-led initiatives to promote student food security and supporting better access to physical and mental health services.

Keywords  
college students, COVID-19, food security, food insecurity, mental health, university students
1  |  INTRODUCTION

Having consistent and socially acceptable access to food is an important pillar for physical, mental and social health (Gundersen & Ziliak, 2015). Food security is defined as having sustainable, physical, social and economic access to food that is sufficient, safe and nutritious and is accessed in socially acceptable ways (Food and Agriculture Organization & Committee on World Food Security, 2012). Food insecurity occurs when one or more of these factors are not met. Food insecurity is a growing problem in countries such as Australia (Booth & Smith, 2001; Booth & Whelan, 2014; Pollard & Booth, 2019; Seivwright et al., 2020) and is linked to mental health concerns such as anxiety, stress and social isolation (Pourmotabbed et al., 2020). Further, food insecurity is associated with nutritionally compromised intake impacting physical health (Moore et al., 2021).

In Australia, COVID-19 was first detected in January 2020. Since then, the states and territories have had varied approaches to restrictions to contain the virus. Of the seven states and territories in Australia, Victoria had the longest and most restrictive lockdown in the country. In 2020, Victoria was in lockdown for 112 days (Australian Taxation Office, 2021), which included work from home orders or industry closures, school and childcare closures, tertiary education institutions moving to online teaching, reduced food retail hours and purchasing restrictions on food and household goods (Parliament of Australia, 2021). In this period, Victoria also experienced a 3.7% decrease in employment. In an attempt to buffer household incomes, the Australian government provided nationally available financial support packages (JobKeeper and JobSeeker) (Australian Taxation Office, 2021). However, the lack of regular support networks, casual work and additional food provisioning was shown to increase stress and impact on food security status (Kleve et al., 2021; Leddy et al., 2020). Victorian residents reported higher rates of worry and negative mental and emotional health outcomes due to the restrictions (Fisher et al., 2020). Further, students and individuals living alone were more likely to report that they had significant negative implications due to the restrictions (Fisher et al., 2020). Due to the recognised impacts on nutritional intake and mental health, there have been calls for more research into the impacts of food security during COVID-19, particularly to understand the impact on vulnerable populations (Neff, 2020).

Even prior to COVID-19, university students were at increased risk of food insecurity. Pre-COVID-19 estimates suggest that up to 48% of Australian university students experienced food insecurity (Whatnall et al., 2020). There are multiple contributing factors to this which include unstable financial resources due to casual work, increasing living expenses including rent and educational costs, limited time for food provisioning and cooking and a lack of culturally appropriate foods (Hattangadi et al., 2019), particularly for international students (Moore et al., 2021; Zimont et al., 2021). Unsurprisingly, these factors have been shown to decrease the quality and quantity of food consumed (Moore et al., 2021). Food insecurity has somewhat been normalised in student populations, whereby eating cheap and highly processed foods is widespread and expected (Hattangadi et al., 2019). In America, 34.5% of students were considered to be food insecure during COVID-19 lockdowns (Owens et al., 2020). University in Australia is a different experience. There are less upfront educational costs, and students may stay living at home or closer to the family house when compared to America. However, throughout 2020, Australia, in particular Victoria, witnessed some of the most strict and prolonged COVID-19 restrictions seen around the world. Despite international literature reporting high levels of food insecurity in university students, particularly during COVID-19, there is little known about how the COVID-19 restrictions may have impacted this situation in Australia and throughout ongoing physical distancing measures.

The aim of this study was to describe the prevalence, severity, coping strategies and precipitating factors of food insecurity in university students in a large multi-campus Australian university during the COVID-19 lockdown in 2020, in context of providing information to inform institutional support.
2 | MATERIAL AND METHODS

2.1 | Data collection

This food insecurity research is part of a larger university-led research project, the Thrive@Home study, which aimed to explore the predictors associated with university students’ psychological well-being during the COVID-19 pandemic. The methods of this study have been previously reported (Liu et al., 2021). Briefly, as part of Thrive@Home, data were collected using online surveys delivered via Qualtrics XM (Provo, Utah, USA) at five time points across 2020 (May, July, August, October and December). Emailed invitation links to the online survey were sent to all undergraduate and postgraduate university students enrolled with a major Australian public research university, Monash University, at its Australian (multi-site) or Malaysian campuses. The Thrive@Home study included a total of 3973 participants across the five time points, with an overall response rate of 4.7% (based on 84,248 students enrolled across the university in 2020). Participants aged 18 and above who provided informed consent were eligible to participate in the study. The Thrive@Home study was approved by the Human Research Ethics Committee at Monash University (Project Number 23969). The current analysis was approved by Monash University’s Human Research Ethics Committee (Project Number 26376).

This analysis specifically examined data collected in the July and October 2020 time points of the wider Thrive@Home study. This time period is significant as it reflects the 112 days of lockdown for the metropolitan area of greater Melbourne (July 8 to October 27) during the COVID-19 pandemic. The aim of this analysis is to explore food security status and associated sociodemographic factors. This analysis will only report on the findings obtained from students living in Australia, who completed the eating habit section of the survey. Overall, n = 1315 completed the survey and were included in the analysis.

Demographic information including age, gender, identity as an Aboriginal and/or Torres Strait Islander, international student status (e.g., identify as international/ domestic student), living alone status (e.g., living on-campus or off-campus, living alone or living with family, partners and/or housemates which was dichotomised into living alone or not living alone), degree type, study loading, year level, faculty and employment status was collected at the beginning of the survey.

Food security status and severity was assessed using the validated USDA Household Food Security Survey Module: Six-Item Adult Short Form (Bickel et al., 2000). The USDA protocol uses the number of affirmative responses to questions to provide a raw score to categorising adult food security: high food security (score of 0), marginal food security (score of 1), low food security (score of 2–4) and very low food security (score of 5–6) (Bickel et al., 2000). Additional survey questions were included to provide insight to additional causes and coping strategies of food insecurity.

The following measures of depression and anxiety were administered using the Patient-Reported Outcomes Measurement Information System (PROMIS) Depression and Anxiety Eight-Item (8a) Scales (Pilkonis et al., 2011). Measures including: The Brief Resilience Scale (Smith et al., 2008), PROMIS Emotional Support Short Form (Hahn et al., 2014), PROMIS Social Isolation Short Form (Hahn et al., 2014), Perceived Stress Scale (PSS-10) (Nielsen et al., 2016) and the World Health Organization (WHO) Psychological Well-being Index (WHO-5) (Topp et al., 2015) were also administered.

Additional COVID-19-specific items and lifestyle factor items were developed in-house and created for the purposes of the Thrive@Home study to explore students’ current situation during COVID-19. These COVID-19 impact items examined the participants’ perceived impacts of the pandemic in the preceding 2 weeks, including whether a family member had been diagnosed with COVID-19 and the impact of COVID-19 and associated restrictions on their mental health and well-being. Lifestyle factors during COVID-19 (time spent outside, perceived sufficiency of using distance communications, dietary change), mental health status and physical health status were examined using self-rated questions. Self-rated mental current health was measured using a single question ‘How would you rate your current mental health?’, whilst self-rated physical health status was measured using a single question ‘How do you rate your current physical health?’ response options ranged from ‘poor’ to excellent. Previously published research from the Thrive@Home study cohort details the survey measures and reliability (Liu et al., 2021).

2.2 | Analysis

All statistical analyses were carried out using Stata statistical software, version 15-0 (College Station, TX: Stata Corp LLC). The percentages of gender, employment, living situation (either at living alone or not living alone), study loading (full-time or part-time), degree, faculty, self-rated physical health, self-rated mental health and self-reported diet quality, stress about current restrictions in the last 2 weeks and stress level since lockdown started were presented. The mean and standard deviation for all continuous variables, age in years, WHO-5, PSS-10, PROMIS anxiety and PROMIS depression was presented. Chi-squared was used to compare demographic and mental health variables and the four food security groups.

Multivariable regression analysis was conducted. The analysis was stratified by food security status group (high-, marginal-, low- and very low food security) for WHO-5, PSS-10, PROMIS anxiety and PROMIS depression. Covariates used in the multivariable model were those identified using descriptive statistics to be significant between food security status by severity. A sensitivity analysis was conducted to include all responses to demographic data that were either missing or the participants responded ‘prefer not to answer’ in the multivariable regression analysis. The difference between covariates with or without missing data results in the modules was negligible. The residuals were plotted against fitted values of the predicted variable to check the assumptions for the regression analysis were met. p-values of <0.05 were considered as statistically significant for all tests, and 95% confidence intervals were presented with results.
Results

Within the sample, 18% experienced food insecurity (low and very low food security), 14% were marginal food secure and 68% had high food security, according to the USDA Household Food Security Survey Module. Table 1 outlines the demographic characteristics of food security status. There was a significant stepwise relationship between those that were international students, unemployed and looking for work (p < 0.001), living alone (p < 0.001) and completing a postgraduate degree (p = 0.005) and worsening food security status. In terms of faculty enrolment, those in the Business and Economics and Information Technology faculties also had a stepwise relationship with food security status (p < 0.001). Mental health (PROMIS anxiety, PROMIS depression and self-rated mental health) was inversely associated with food security status (p < 0.001).

Table 2 outlines food security experiences, causes and coping strategies. The USDA Household Food Security Survey Module – Six-Item Adult Short Form shows higher prevalence of food not lasting the pay period, not being able to eat balanced meals, skipping meals and reducing the size of meals increased as food security worsened (p < 0.001). Further, there was stepwise relationship between the prevalence of barriers to food availability, financial access, physical access, utilisation of the food and physical and/or mental conditions that impede food access and worsening food security status (p < 0.001). In terms of coping strategies, as food security status deteriorated the prevalence of needing to ask family or friends for food, needing to shop at multiple outlets for discounts, the use of emergency food relief, accessing subsidised meals and financial assistance from organisations increased (p < 0.002).

Table 3 shows the relationship between food security status and mental health outcomes. Unadjusted models show that as food security status deteriorates, the risk of anxiety and depression (as per PROMIS) and stress (as per PSS-10) increases. Further, food insecurity has a negative relationship with well-being (WHO-5). After adjusting for living alone, employment status, degree type, gender, faculty and international student status, the relationship between food security status and PROMIS anxiety and depression outcomes, stress and well-being were slightly attenuated, but remained significant.

Discussion

The aim of this study was to describe the prevalence, severity, coping strategies and precipitating factors of food security in university students in Melbourne, Australia, during the COVID-19 lockdown. The results showed that those that were unemployed and looking for work, enrolled in a postgraduate degree, in the Faculty of Business and Economics and IT who were also living alone were more likely to have increased prevalence of food insecurity, from marginal through to very low. Individual coping strategies most commonly used were asking family and friends for food, shopping at multiple outlets, using emergency food relief, subsidised meals or financial assistance from organisations. The prevalence and frequency of these coping strategies increased as food security status deteriorated. Further, worsening mental health was associated with deteriorating food security status.

Food insecurity in Australian university students is not exclusively related to COVID-19. Prior to COVID-19, the prevalence of food insecurity was reported to be between 13 and 48% (Gallegos et al., 2014; Hughes et al., 2011; Micevski et al., 2014; Whatnall et al., 2020). In the current study, the prevalence of food insecurity is 18% with a further 14% experiencing marginal food insecurity. Of the students that experienced food insecurity, students were more likely to be living alone, looking for work and completing a postgraduate degree. Previous studies have identified that students living alone are more likely to experience food insecurity (Bruening et al., 2017; Bruening et al., 2018; Hattangadi et al., 2019; McArthur et al., 2018; Micevski et al., 2014). However, our findings contradict previous reports that suggest undergraduates are at higher risk of food insecurity due to lower education level as a predictor of income (Whatnall et al., 2020). In Australia, postgraduate students are less likely to be eligible for social support payments such as Austudy or Youth Allowance (Council of Australian Postgraduate Associations, 2019). Universities do have stipends available, but these are usually competitive and are not means tested (Council of Australian Postgraduate Associations, 2019). Therefore, postgraduate students often work on top of their study and some may work cash in hand. During COVID-19 lockdowns, it is possible that this work was not available to them, especially in retail and hospitality sectors and therefore impacted their income and financial access to food. Additionally, students on international visa’s were not eligible for the federal government’s available financial support packages (JobKeeper and JobSeeker).

Whilst 18% of the sample experienced food insecurity, 27% and 73% of those with low and very low food security experienced hunger as a consequence, which is significantly higher than previous Australian reports (Micevski et al., 2014). This indicates that whilst the overall prevalence is lower than previously reported, those that were experiencing food insecurity were potentially experiencing a more severe form of food insecurity. The financial burden of living alone and covering all living expenses alone whilst studying is a known predictor of food insecurity, particularly in major capital cities (Melbourne and Sydney) where living expenses are high (Duncan et al., 2017). Even 10% of the students who reported high food security reported that money did not stretch as far as they need to cover rent, bills and medicines. It is possible that the government support during COVID-19 (JobSeeker and JobKeeper) may have provided a buffer which prevented some students from experiencing food insecurity. Whilst financial access to food is only one factor that may influence food security status, this may be preliminary evidence that university students require more financial support to prevent food insecurity, which has also been supported by approaches, particularly in America (Bruening et al., 2017). However, more research is needed to support students who are currently experiencing food insecurity internationally.
| Demographic Characteristics                                      | High food security (n = 887) | Marginal food security (n = 189) | Low food security (n = 176) | Very low food security (n = 63) | p-value |
|------------------------------------------------------------------|------------------------------|----------------------------------|-----------------------------|--------------------------------|---------|
| **Age**                                                         | 24.5 (8.0)                   | 24.3 (7.2)                       | 24.1 (5.4)                  | 23.2 (3.4)                     | 0.7     |
| **Gender**                                                      |                              |                                  |                             |                                |         |
| Female                                                          | 41.9 (372)                   | 42.9 (81)                        | 46.6 (82)                   | 55.6 (35)                      | 0.029*  |
| Male                                                            | 17.6 (156)                   | 27.0 (51)                        | 20.5 (36)                   | 14.3 (9)                       |         |
| Non-binary                                                      | 0.8 (7)                      | 2.1 (4)                          | 0.6 (1)                     | 1.6 (1)                        |         |
| **Employment**                                                  |                              |                                  |                             |                                |         |
| Full-time                                                       | 4.6 (41)                     | 3.2 (6)                          | 2.3 (4)                     | 3.2 (2)                        | <0.001* |
| Part-time                                                       | 24.8 (220)                   | 24.3 (46)                        | 12.5 (22)                   | 7.9 (5)                        |         |
| Unemployed looking                                             | 15.3 (136)                   | 21.7 (41)                        | 32.4 (57)                   | 41.3 (26)                      |         |
| Unemployed not looking                                         | 15.7 (139)                   | 22.8 (43)                        | 20.5 (36)                   | 17.5 (11)                      |         |
| **Living situation**                                           |                              |                                  |                             |                                |         |
| Living alone                                                    | 9.6 (85)                     | 12.2 (23)                        | 25.0 (44)                   | 27.0 (17)                      | <0.001* |
| Not living alone                                                | 50.9 (451)                   | 59.8 (113)                       | 42.6 (75)                   | 42.9 (27)                      |         |
| **International student status**                               |                              |                                  |                             |                                |         |
| International student living in Australia                      | 16.8 (149)                   | 27.0 (51)                        | 48.3 (85)                   | 52.4 (33)                      | <0.001* |
| Non-international (domestic) student living in Australia       | 43.4 (385)                   | 44.4 (84)                        | 18.8 (33)                   | 17.5 (11)                      |         |
| **Study loading**                                               |                              |                                  |                             |                                |         |
| Full-time                                                       | 53.6 (475)                   | 67.2 (127)                       | 66.5 (117)                  | 66.7 (42)                      | <0.001* |
| Part-time                                                       | 6.9 (61)                     | 4.8 (9)                          | 1.1 (2)                     | 3.2 (2)                        | <0.001* |
| **Degree**                                                      |                              |                                  |                             |                                |         |
| Undergraduate                                                   | 22.4 (199)                   | 25.4 (48)                        | 22.2 (39)                   | 25.4 (16)                      | 0.005*  |
| Undergraduate (with honours year)                              | 10.9 (97)                    | 10.6 (20)                        | 9.1 (16)                    | 7.9 (5)                        |         |
| Undergraduate (with double major)                              | 6.1 (54)                     | 6.4 (12)                         | 3.4 (6)                     | 0.0 (0)                        |         |
| Postgraduate degree (e.g., Masters and PhD)                    | 20.3 (180)                   | 28.6 (54)                        | 33.0 (58)                   | 34.9 (22)                      |         |
| Other                                                           | 0.7 (6)                      | 1.1 (2)                          | 0.0 (0)                     | 1.6 (1)                        |         |
| **Faculty**                                                     |                              |                                  |                             |                                | <0.001* |
| Arts                                                            | 8.6 (76)                     | 7.4 (14)                         | 6.8 (12)                    | 3.2 (2)                        |         |
| Art, Design and Architecture                                   | 2.6 (23)                     | 7.4 (14)                         | 4.6 (8)                     | 6.4 (4)                        |         |
| Business and Economics                                         | 7.3 (65)                     | 8.5 (16)                         | 18.8 (33)                   | 20.6 (13)                      |         |
| Education                                                       | 4.1 (36)                     | 4.8 (9)                          | 5.1 (9)                     | 3.2 (2)                        |         |
| Engineering                                                    | 3.0 (27)                     | 6.4 (12)                         | 6.3 (11)                    | 4.8 (3)                        |         |
| Information Technology                                         | 3.8 (34)                     | 6.4 (12)                         | 7.4 (13)                    | 12.7 (8)                       |         |
| Law                                                             | 1.9 (17)                     | 0.5 (1)                          | 2.3 (4)                     | 1.6 (1)                        |         |
| Medicine, Nursing and Health Sciences                           | 11.6 (103)                   | 12.2 (23)                        | 6.3 (11)                    | 7.9 (5)                        |         |
| Pharmacy and Pharmaceutical Sciences                            | 1.9 (17)                     | 4.2 (8)                          | 2.3 (4)                     | 1.6 (1)                        |         |
| Science                                                         | 4.5 (40)                     | 3.2 (6)                          | 4.6 (8)                     | 6.4 (4)                        |         |
| Double degree                                                   | 10.8 (96)                    | 10.6 (20)                        | 2.8 (5)                     | 1.6 (1)                        |         |
| **Self-rated physical health**                                  |                              |                                  |                             |                                |         |
| Excellent                                                       | 16.5 (146)                   | 6.4 (12)                         | 15.3 (27)                   | 14.3 (9)                       | 0.001*  |
| Very good                                                       | 32.5 (288)                   | 31.2 (59)                        | 22.7 (40)                   | 22.2 (14)                      |         |
| Good                                                            | 47.6 (422)                   | 55.6 (105)                       | 55.1 (97)                   | 57.1 (36)                      |         |
| Poor                                                            | 3.3 (31)                     | 6.9 (13)                         | 6.8 (12)                    | 6.4 (4)                        |         |

(Continues)
Over the period of data collection, metropolitan Melbourne was subjected to a 5 km travel restriction (Parliament of Australia, 2021). This restriction may have significantly influenced students’ physical access to food. Of the students that were experiencing food insecurity 30%–35% reported that a barrier to food was that the shops were too difficult to get to. Further, 34%–52% reported that a mental health or physical condition impacted their physical access to cook or eat enough and nutritious food. It was also more common for those that experienced food insecurity to report that they could not access culturally appropriate food. The 5 km travel restriction and the banning of visitors to the house (Parliament of Australia, 2021) may have influenced what coping strategies the students had access to. Some students may have utilised family and friends’ houses as a way to cope with food insecurity. However, this was illegal under the restrictions and unsurprisingly, no student reported utilising this resource.

There was a clear stepwise relationship between deteriorating food security status and mental health. It is important to note that the relationship between food security and mental health has been reported to be bidirectional prior to the pandemic (Maynard et al., 2018). However, during COVID-19 lockdowns, mental health issues increased in the Australian population (Fisher et al., 2020). Therefore, these results need to be interpreted in context of increased mental health pressures. In a tertiary student population, this is particularly important as it can impact academic performance, substance use and adverse physical health (Bruening et al., 2017; Bruening et al., 2018; Pascoe et al., 2020). This supports previous work on tertiary students which suggests that food insecurity is related to poorer academic performance, directly and indirectly through mental health status (Martinez et al., 2020). Many calls have been made, even prior to the COVID-19 pandemic, to provide students with more help to meet their basic needs, however, this call

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**TABLE 1** (Continued)

|                              | High food security (n = 887) | Marginal food security (n = 189) | Low food security (n = 176) | Very low food security (n = 63) | p-value |
|------------------------------|-----------------------------|---------------------------------|-----------------------------|---------------------------------|---------|
| **Self-reported diet quality decrease since March 2020** |                             |                                 |                             |                                 | <0.001* |
| No                           | 51.6 (458)                  | 34.4 (65)                       | 30.1 (53)                   | 27.0 (17)                       |         |
| Yes                          | 48.4 (429)                  | 65.6 (124)                      | 69.9 (123)                  | 73.0 (46)                       |         |
| **Self-rated mental health** |                             |                                 |                             |                                 | <0.001* |
| Excellent                    | 6.0 (53)                    | 1.1 (2)                         | 3.4 (6)                     | 4.8 (3)                         |         |
| Very good                    | 16.8 (149)                  | 14.3 (27)                       | 14.8 (26)                   | 4.8 (3)                         |         |
| Good                         | 26.4 (234)                  | 20.6 (39)                       | 18.8 (33)                   | 17.5 (11)                       |         |
| Fair                         | 17.7 (157)                  | 20.6 (39)                       | 14.2 (25)                   | 17.5 (11)                       |         |
| Average                      | 14.5 (129)                  | 20.6 (39)                       | 15.3 (27)                   | 22.2 (14)                       |         |
| Below average                | 18.6 (165)                  | 22.8 (43)                       | 33.5 (59)                   | 33.3 (21)                       |         |
| **Stress about current restrictions in the last 2 weeks** |                             |                                 |                             |                                 | <0.001* |
| Extremely                    | 7.0 (62)                    | 10.1 (19)                       | 19.9 (35)                   | 25.4 (16)                       |         |
| Very                         | 17.6 (156)                  | 21.2 (40)                       | 29.0 (51)                   | 31.8 (20)                       |         |
| Moderately                   | 34.6 (307)                  | 32.8 (62)                       | 27.3 (48)                   | 36.5 (23)                       |         |
| Slightly                     | 28.6 (254)                  | 25.4 (48)                       | 18.2 (32)                   | 4.8 (3)                         |         |
| Not at all                   | 12.2 (108)                  | 10.6 (20)                       | 5.7 (10)                    | 1.6 (1)                         |         |
| **Stress levels since the lockdowns started** | 0.004*                      |                                 |                             |                                 |         |
| Extremely                    | 20.1 (178)                  | 24.9 (47)                       | 27.3 (48)                   | 39.7 (25)                       |         |
| Very                         | 26.5 (235)                  | 29.6 (56)                       | 32.4 (57)                   | 28.6 (18)                       |         |
| Moderately                   | 24.6 (218)                  | 20.6 (39)                       | 17.6 (31)                   | 19.1 (12)                       |         |
| Slightly                     | 18.4 (163)                  | 14.3 (27)                       | 17.1 (30)                   | 9.5 (6)                         |         |
| Never                        | 10.5 (93)                   | 10.6 (20)                       | 5.7 (10)                    | 3.2 (2)                         |         |
| **WHO-5 Well-being Index**   | Mean (SD)                   | Mean (SD)                       | Mean (SD)                   | Mean (SD)                       | <0.001* |
| Perceived Stress Scale (PSS-10) | 20.5 (7.1)                | 22.7 (6.3)                      | 24.3 (6.1)                  | 25.4 (5.8)                      | <0.001* |
| PROMIS anxiety               | 59.6 (9.3)                  | 61.4 (9.1)                      | 63.9 (9.4)                  | 67.8 (9.5)                      | <0.001* |
| PROMIS depression            | 56.8 (9.6)                  | 59.1 (9.4)                      | 61.7 (9.4)                  | 65.0 (10.3)                     | <0.001* |

Note: Chi-squared was used to compare demographic and mental health variables and the four food security groups.
*A total of 480 participants did not answer the following questions: age, gender, living situation or study loading, degree type or faculty.
*Statistically significant.
TABLE 2  University student food security experiences, causes and coping strategies by food security status during COVID-19 in lockdown March–July 2020<sup>a</sup> (total sample = 1315)

| | High food security (n = 887) | Marginal food security (n = 189) | Low food security (n = 176) | Very low food security (n = 63) | p-value |
|---|---|---|---|---|---|
| USDA Household Food Security Survey Module: Six-item food security short form | | | | | <0.001* |
| The food that I bought just didn't last, and I didn't have money to get more | | | | | | <0.001* |
| Never true | 0.5 (4) | 85.7 (162) | 21.6 (38) | 1.6 (1) | | <0.001* |
| Sometimes true | 0 (0) | 3.2 (6) | 66.5 (117) | 68.3 (43) | | | |
| Often true | 0 (0) | 0 (0) | 7.4 (13) | 28.6 (18) | | | |
| I couldn't afford to eat balanced meals | | | | | <0.001* |
| Never true | 0 (0) | 74.1 (140) | 25.6 (45) | 3.2 (2) | | | <0.001* |
| Sometimes true | 0 (0) | 19.1 (36) | 63.6 (112) | 60.3 (38) | | | |
| Often true | 0 (0) | 1.6 (3) | 8.5 (15) | 36.5 (23) | | | |
| Did you or other adults in your household ever cut the size of your meals or skip meals because there was not enough money for food? | | | | | <0.001* |
| 0 (0) | 0 (0) | 17.6 (31) | 100 (63) | | | <0.001* |
| How often does this happen? | | | | | <0.001* |
| Some months but not every month | 0 (0) | 0 (0) | 8.0 (14) | 47.6 (30) | | | <0.001* |
| Only once per month | 0 (0) | 0 (0) | 2.8 (5) | 7.9 (5) | | | |
| Almost every month | 0 (0) | 0 (0) | 2.3 (4) | 42.9 (27) | | | |
| Did you ever eat less than you felt you should because there was not enough money for food? | | | | | <0.001* |
| Yes | 0.0 (0) | 2.1 (4) | 42.6 (75) | 98.4 (62) | | | | <0.001* |
| No | 0.9 (8) | 91.0 (172) | 44.9 (79) | 1.6 (1) | | | |
| Were you ever hungry but didn’t eat because there was not enough money for food? | | | | | <0.001* |
| Yes | 0.0 (0) | 0.0 (0) | 27.3 (48) | 73.0 (46) | | | | <0.001* |
| No | 0.9 (8) | 94.2 (178) | 62.5 (110) | 22.2 (14) | | | |
| Additional food access questions | | | | | <0.001* |
| Have you been able to afford or access fruits and vegetables to eat on most days? | | | | | | | <0.001* |
| Never | 0.1 (1) | 2.1 (4) | 3.4 (6) | 14.3 (9) | | | |
| Sometimes | 0.6 (5) | 28.0 (53) | 58.5 (103) | 73.0 (46) | | | |
| Often | 0.7 (6) | 66.1 (125) | 35.8 (63) | 12.7 (8) | | | |
| Additional reasons why people may not have enough food or nutritious food since COVID related in March 2020 | | | | | <0.001* |
| There just isn't enough money for food | 1.0 (9) | 0.0 (0) | 15.9 (28) | 66.7 (42) | | | <0.001* |
| There are too many other things to pay for (such as rent, bills and medicines) | 9.6 (85) | 18.5 (35) | 63.6 (112) | 88.9 (56) | | | <0.001* |
| The food in shops or supermarkets costs too much | 8.4 (75) | 11.6 (22) | 44.9 (79) | 65.1 (41) | | | <0.001* |
| It is too hard to get to the store shops supermarket or market | 10.6 (94) | 20.6 (39) | 34.7 (61) | 30.2 (19) | | | <0.001* |
| The store shops, supermarket or market is too far away | 2.6 (23) | 8.5 (16) | 15.9 (28) | 14.3 (9) | | | <0.001* |
| The shops don't sell or stock nutritious food | 0 (0) | 0 (0) | 0 (0) | 0 (0) | N/A | | |
| Food that is familiar or appropriate for our culture or religion is not available | 2.4 (21) | 2.7 (5) | 6.8 (12) | 11.1 (7) | | | <0.001* |

(Continues)
The current study highlights a situation where additional stress was put on students as they tried to navigate online classes, travel restrictions and possibly financial support changes. Therefore, important learning about supporting students financially, providing socially acceptable access to food and mental health support should be considered by policy makers and stakeholders who respond to future disasters (pandemics, weather events, terrorism, geopolitical instability) to support the academic performance, health and well-being of students.

### 5 | IMPLICATIONS

Currently, the most widely adopted strategies by the university sector to address food insecurity in students are food banks, pantries, vouchers/discounts for food and limited educational programs to improve financial and food literacy (Whatnall et al., 2020; Bruening et al., 2017; ‘Okanagan Charter: An International Charter for Health Promoting Universities and Colleges,’ 2015). Food pantries and food banks are a food safety net often facilitated by student body associations relying on donated product or the distribution of rescued food and or students may access such food relief services in the broader community. Accessing such services is associated with high levels of stigma (Gallegos et al., 2014) and may further impact the stress of the experience of food insecurity including mental well-being. Generally, university students have been shown to have adequate food and financial literacy, but the reality is essential expenses exceeded income (Moore et al., 2021). This is supported by our finding of students reported coping mechanism of multiple food procurement strategies such as shopping for specials or discounts across a number of food outlets. Further, these strategies only superficially address or provide short-term relief to the acute or chronic impacts of food security (Whatnall et al., 2020). This analysis shows that increasing employment opportunities, improving physical access to food and supporting access to physical and mental health services may all be factors that need to be considered by universities to more appropriately support student food security. Strategies such as increasing employment opportunities and the use of community gardens and healthy food retailers on campus have previously been raised as possible strategy targets (Bruening et al., 2017; Gallegos et al., 2014; Whatnall et al., 2020). Along with mental health strategies, the efficacy of these targets has not been studied long term. This provides an opportunity for universities to

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**TABLE 2 (Continued)**

| High food security (n = 887) | Marginal food security (n = 189) | Low food security (n = 176) | Very low food security (n = 63) | p-value |
|-----------------------------|---------------------------------|-----------------------------|-------------------------------|---------|
| % (n)                       | % (n)                           | % (n)                       | % (n)                         |         |
| I don’t know what to buy    | 0 (0)                           | 0 (0)                       | 0 (0)                         | N/A     |
| I don’t know how to prepare or cook food | 5.0 (44) | 12.2 (23) | 11.9 (21) | 7.9 (5) | <0.001* |
| No place to store food safely | 0.8 (7) | 2.7 (5) | 8.5 (15) | 11.1 (7) | <0.001* |
| Don’t have the equipment to prepare and cook food | 0 (0) | 0.0 (0) | 0 (0) | 0 (0) | N/A     |
| Kitchen is not sufficient or safe for cooking | 0.7 (6) | 1.6 (3) | 5.7 (10) | 7.9 (5) | <0.001* |
| Not enough time to cook or shop | 9.4 (83) | 21.2 (40) | 18.8 (33) | 15.9 (10) | <0.001* |
| Physical or mental health condition that stops me being able to cook or eat | 18.7 (166) | 27.5 (52) | 33.5 (59) | 52.4 (33) | <0.001* |

| Coping strategies with not having access to enough food | % (n) | % (n) | % (n) | % (n) | p-value |
|--------------------------------------------------------|-------|-------|-------|-------|---------|
| Visited family and/or friends specifically to eat at mealtime and or snacks | 0 (0) | 0 (0) | 0 (0) | 0 (0) | N/A     |
| Asked family and/or friends for food                    | 0 (0) | 1.1 (2) | 2.8 (5) | 12.7 (8) | <0.001* |
| Asked family or friends for money for food              | 0 (0) | 1.1 (2) | 0.6 (1) | 1.6 (1) | 0.002*  |
| Shopped at a number of food outlets for food specials/discounts | 0.1 (1) | 9.0 (17) | 26.7 (47) | 36.5 (23) | <0.001* |
| Used emergency food relief or food banks to get food items or vouchers for food | 0 (0) | 2.7 (5) | 9.7 (17) | 19.1 (12) | <0.001* |
| Accessed or received meals for no to low cost from organisation | 0 (0) | 4.8 (9) | 8.0 (14) | 11.1 (7) | <0.001* |
| Accessed or received financial assistance from organisations | 0 (0) | 1.1 (2) | 8.5 (15) | 15.9 (10) | <0.001* |

*a The questions use the phrase ‘Since March 2020 to now’ to capture how they felt at this particular time period. Chi-squared test was used to compare the USDA Household Food Security Survey Module: Six-Item adult Short Form and other food security questions stratified by the four food security groups.

*Statistically significant.
pilot potential strategies inclusive of but beyond food provisioning programs and monitor food insecurity and its impacts on student well-being and outcomes within their campuses before large-scale need increases again. Furthermore, in addition to these institutional level approaches, as living costs increase, this highlights the potential opportunities for universities to engage and work with government and welfare organisations to advocate for strategies considering: supporting higher education income support, affordable student accommodation, healthcare access, scholarship access for under and postgraduate students and institution funding schemes for students in need (Gallegos et al., 2014; Whatnall et al., 2020).

6 | STRENGTHS AND LIMITATIONS

This paper is the first to report food insecurity from the perspective of Australian university students during COVID-19. Strengths and limitations of the THRIVE@Home study have been reported elsewhere (Liu et al., 2021). Food security status was determined using the validated and widely used USDA Household Food Security Survey Module: Six-Item adult Short Form. Further, this analysis represents over 1000 students across a multi-campus university, multi-faculty and degree type. However, this analysis does have its limitations. This was a cross-sectional analysis, so therefore causation cannot be inferred. Whilst the study utilised validated questionnaires, the outcomes were self-reported, and some demographic data were able to be skipped, therefore reporting bias needs to be acknowledged in the interpretation of these results.

7 | CONCLUSION

The results of this analysis show that 18% of students experienced food insecurity over COVID-19 2020 lockdowns in Victoria, Australia. Students utilised personal coping strategies such as asking family and friends for food, shopping at multiple outlets, using emergency food relief, subsidised meals or financial assistance from organisations. Mental health was a strong predictor of food security status for students. This paper provides targets for future university-led initiatives and advocacy opportunities with government and welfare organisations to promote student food security and supporting better access to physical and mental health services.

AUTHOR CONTRIBUTION

Conceptualisation and refining of research idea and Research Survey design: Thrive@Home survey KC, MCC, Food Security Questions and Thrive@Home SK, MMcC, KC, MC. Data collection of Thrive@Home survey: MMcC, KC. Data synthesis and statistical analyses: MC, SK, CB, Data Synthesis only: SY. Interpretation of analyses: CB, SK MC, SY. Preparation of manuscript: CB, SK, MC, SY, MMcC, KC. Review and approval of manuscript: all authors. Supervision of food security study: SK.
ACKNOWLEDGEMENTS
Thank you to the team and Monash University who helped make the Thrive surveys possible. Thank you to Mr Chad Cyronz for assisting in data cleaning prior to analysis. Open access publishing facilitated by Monash University, as part of the Wiley - Monash University agreement via the Council of Australian University Librarians.

CONFLICT OF INTEREST
The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT
No data are available

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**How to cite this article:** Bennett, C. J., Christian, M., Phan, S., McCabe, M., Cornish, K., & Kleve, S. (2022). Food insecurity during COVID-19: An Australian university experience. *Health & Social Care in the Community*, 00, 1-11. [https://doi.org/10.1111/hsc.13962](https://doi.org/10.1111/hsc.13962)