2014

Food security among students at University of Wollongong

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BPubHlth (Nutrition)

This thesis is presented as part of the requirements for the award of the Degree of

Master of Sciences (Research)

University of Wollongong

July 2014

CERTIFICATION

I, Reima Mansour, declare that this thesis, submitted as part of the requirements for the award of the degree of Master of Sciences (Research), in the School of Health Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for any qualifications at any other academic institution.

Reima Mansour

ABSTRACT

Background: Food insecurity occurs whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain. There has been limited research into food security among university students, although one previous study in Queensland reported the prevalence of food insecurity with hunger up to 25% and 46.5% food insecure without hunger using a multi item question, and 12.7% using a single item question to assess food insecurity.

This study aimed to investigate the level of food security among university students attending the University of Wollongong (UOW). It investigated the extent of food insecurity among domestic and international students and the factors influencing access to and preparation of foods suitable to meet cultural and religious needs of university students.

Design: An online questionnaire was distributed to all the university's students via UOW student clubs and associations. Food security was measured using both a single item question taken from the Australian National Nutrition Survey (NNS) and multi item questions, based on the United States Department of Agriculture (USDA) Community Food Security Assessment Toolkit. Students were also asked about purchasing behaviours and cultural requirements of food. The data were assessed using descriptive data analysis, and multiple logistic regression assessed a range of factors associated with reported food insecurity.

Results: A total of 337 students from ten faculties completed the questionnaire; mean age 30 years (range 18 to 68 years). The prevalence of food insecurity among UOW students using the single item measure was 19.6% (n=62). Food insecurity using the

more sensitive multi item measure identified three in five students (60.8%, n=198) experienced some level of food insecurity. More than 37% of the students reported a severe level of food insecurity. The prevalence of food insecurity was higher among international students (70% vs 52% domestic students, p=0.001), coursework students (71% vs 50% research students, p <0.001), students without a car (68.2% vs 56% with a car, p=0.029), unemployed students (68.6% vs 49.2% employed student, p=0.001) and students who were renting (69.3% vs 37.3% in other accommodation, p<0.0001). In the multivariate logistic regression model reporting the price of food as affecting their ability to obtain good food remained significant in the final model. Food insecurity was also reported in households that included children, however, the numbers were too small to conduct meaningful statistical analysis in relation to the other variables.

Discussion: This study found students who were attending the UOW experienced higher levels of food insecurity than have been reported for the general adult Australian population or in other Australian university populations using the single item question. The level of food insecurity was significantly higher than the student community from Mānoa, Hawai'i, however, it was similar to results from a USA study among college students in a rural university. The multi item measures identified other facets of food insecurity are a concern for the student population group. Additional questions about special food needs related to cultural diversity were also important factors in this population group.

Conclusion and Recommendations: This study confirms previous studies which show university students are at significant risk of food insecurity, indicating a need to provide better support services to university students. The study provided a comparison of the single item and multi item instruments used, and included

recommendations to include questions about special food needs. Information from across the sector should be obtained to determine the extent of food insecurity amongst university students throughout Australia.

ACKNOWLEDGEMENTS

First praise is to Allah, the Almighty, on whom ultimately we depend for sustenance and guidance. Second, my sincere appreciation goes to my supervisors Prof. Heather Yeatman, Prof. Vicki Flood and Dr. Deanne Condon-Paoloni, whose guidance, careful reading and constructive comments were valuable. Their time and efficient contribution helped me to shape this study into its final form and I express my sincerest appreciation for their assistance in any way that I may have asked. Also, I would like to acknowledge the students who participated in the study.

I am also deeply indebted to Dr. Marijka Batterham for her invaluable statistical advice on this study. Also, the biostatistician Dr. Jenny Peat was a tremendous mentor for me at the final stage. I would like to express my special appreciation and thanks to my fellows and friends who encouraged me in my interest in this topic.

I am particularly grateful to my unbelievably supportive husband, Tareg Amkhatra, and our pretty daughters, Shahd and Eataq. Tareg has demonstrated rare and amazing patience throughout my lengthy working sessions over my study years since we got married. All of your care and support has been the foundation of my drive to do well.

Finally, I'm forever indebted to my mum, dad, brothers, sisters, nephews and nieces who understand the importance of this work, suffered my years away and being apart for a long time and were very supportive for my study abroad.

Thanks again to everyone who helped me and made this thesis possible.

Sincerely,

Reima Mansour

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ACRONYMS AND ABBREVIATIONS

CI	Confidence Interval
FSSM	US Food Security Survey Module
IHFBI	Illawarra Health Food Basket Index
n	Number
NNS	Australian National Nutrition Survey
NSW	New South Wales
OR	Odds ratios
PIS	Participant Information Sheet
SPC	Food stamps and student price card
SPQ	Strategic Planning and Quality Office
UOW	University of Wollongong
US	United States
USDA	United States Department of Agriculture
WA	Western Australia

1 INTRODUCTION

Food is one of the necessities of life and the right to adequate food was first recognized with the Universal Declaration of Human Rights in 1948, article 25 (United Nations 2013d). However, many of the world's population are at present suffering from one or more forms of food insecurity, ranging from anxiety about obtaining adequate food to actual hunger.

Food security has long been a global issue, with current definitions first emerging almost forty years ago at the World Food Conference in 1974 (FAO 2006). Definitions comprise themes around access, availability and affordability of food. There has been a growing body of research addressing food insecurity among vulnerable groups such as children, adolescents, the elderly, socioeconomically disadvantaged people, immigrants and refugees. Given the potential economic difficulties facing university students such as tuition costs and limited time to attend part-time work, their risk of food insecurity may be high.

The issue of food insecurity among university students is emerging but as yet is still relatively under-researched. Few studies have investigated hunger or the experiences and perspectives of students on food insecurity (Rondeau 2007; Nugent 2011). The prevalence of food insecurity among university students has been measured only by three studies: one in Hawai'i (n=410), USA (Chaparro et al. 2009); one in a rural area in the USA (Patton-López et al. 2014); and the other one was in Queensland (n=399), Australia (Hughes et al. 2011). All of these studies found higher levels of food insecurity among university students compared to the overall population (Chaparro et

al. 2009; Hughes et al. 2011). This is an under-researched field, and more data are required to explore this issue. No studies have yet been completed with university students in New South Wales, Australia.

The current study focuses on food security among domestic and international university students attending the University of Wollongong (UOW), a regional university in New South Wales, Australia. Wollongong is a coastal city in the Illawarra region of New South Wales, about 82 kilometres south of Sydney Large food stores or supermarkets in big shopping centres are more common in Wollongong city than small, independent or convenient food stores. The distribution of small or independent food shops across the city is sporadic. Although large food stores have usually more and cheaper food options than small or independent stores, they may not be accessible and may require transportation and parking facilities (Gittelsohn et al. 2012). Small shops on the other hand may contain limited or more expensive food options but they are generally easily accessible and may not require transportation. The unavailability of multiple well distributed small food shops across the city makes it difficult and inconvenient for people, particularly those without private transport, to access food outlets easily and on a daily basis to meet their needs for healthy and balanced diets (Larson et al. 2009). Currently, there appear to be no future plan to change this situation. The UOW is internationally recognised as one of the best modern universities in the world (ranked 22nd in the world and 2nd in Australia among universities less than 50 years old), with around 24000 students, approximately 26% international students. Figure 1.1 shows the location of Wollongong in New South Wales and Australia.

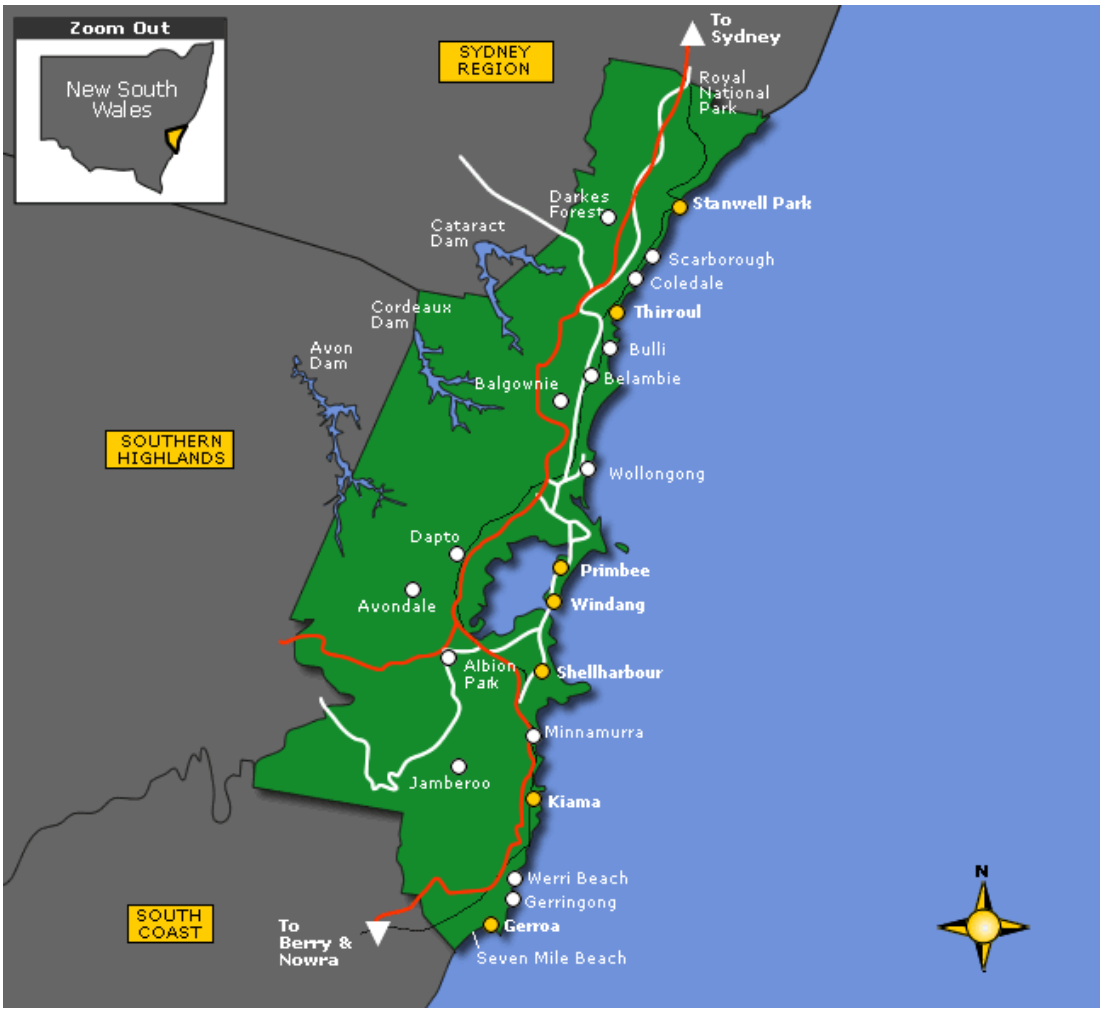

Figure 1.1 The Illawarra region within New South Wales, Australia
Source: (Vacant Moments 2013)

1. 1 Aims and objectives

The aims of this study were to investigate the extent of food security among university students attending the UOW, and to explore factors associated with food insecurity.

The objectives of this study were to:

1. Measure the extent of food insecurity among domestic and international students at the University of Wollongong, NSW.

2. Investigate factors that influence university students' access to and preparation of foods suitable to meet their cultural and religious needs.

This thesis is divided into six chapters. This section outlines the structure of the thesis and gives a concise overview of the succeeding chapters.

Chapter two of this thesis reviews the current and relevant literature and discusses the expanded concept of food security and its prevalence globally. It also explores the relevance of considering food insecurity of university student populations, from the perspective that they are considered a disadvantaged group.

Chapter three outlines the study design and explains the methods used to collect and analyse data and the issues around the university population studied. It describes the tools used in the questionnaire: the single item and multi item measures.

The study findings of this quantitative research project are presented in chapter four. It includes results using both the descriptive and inferential analysis of the students' demographic characteristics, food security issues and food purchasing behaviours. It provides a comparison of the single item and multi item instruments used.

Chapter five discusses the main findings of the study, particularly the high level of food insecurity found in University of Wollongong students. The study conclusions are presented in chapter six, with recommendations for a university working group to focus on food insecurity for students, and for further studies across similar groups. The appendices include the literature review search strategy, full details of the study

design as well as tables of the extended data results. The study design appendices include ethics approval, the questionnaire, invitation letters, participant information sheet and flyer.

2 LITERATURE REVIEW

2. 1 Introduction

This review of the literature broadly identifies concepts related to food security and insecurity, and examines reports of the prevalence of food insecurity and the extent to which it affects different groups in the community. It goes on to discuss the determinants of food security, and identifies those who face food insecurity. It establishes the importance of availability and adequate access to food in order to achieve food security. The links between health, socio-economic status, obesity and food security are then discussed. Previous studies examining experiences of university students in relation to food insecurity are then examined. In particular the association between an immigrant's culture and food purchasing behaviours is explored to better understand particular food-related issues for international students. The search strategy for this literature review is included as Appendix A.

2. 2 Food security concept and definition

Food security has been a global issue since the mid-20th century, mainly related to developing countries and world hunger. The understanding of the concept of food security has evolved over the last thirty years. The nested nature of the global food network has a number of impacts on food security, such as shared social, political, natural and economic challenges. The term “food security” is a multi-dimensional phenomenon (FAO 2006). It has been expanded to reflect the important relationships and interactions between food and culture, because food is much more than merely a tool to sustain life.

There are two related concepts, which have the same name but measure two different things. One is food security at the country-level, which refers to the ability of a country to provide enough food to its citizens. The other is food insecurity at the household-level, referring to the inability to acquire adequate nutritious foods in socially acceptable ways due to economic constraints (Anderson 1990).The subject matter of this study will not address the concept of food security at the country-level

Definitions of food security reflect the social conditions of the time. The first definition at the World Food Conference arose in a time of major economic crisis in the mid-1970s, and is as follows:

Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices (Maxwell and Smith 1992, p 86).

This definition framed food security in terms of food supply, assuring the availability and price stability of essential foodstuffs at the national and international level. Subsequent economic crisis also led to re-examination of the concept of food security, as indicated by the U.N.'s Food and Agricultural Organization (FAO) in 1983 as "*Ensuring that all people at all times have both physical and economic access to the basic food that they need*" (FAO 2006 p.1). This definition is based on the balance between demand and supply of the food security equation and focused on food access.

More recently in food security analyses, broader dimensions of food security have been introduced, in response to the inadequacy of the previous definitions to describe the more local manifestations of food security that impact at the household and

individual levels, in addition to regional and national levels of aggregation. In 1986, the highly influential World Bank report, “Poverty and Hunger”, elaborated on the definition of food security in terms of “access of all people at all times to enough food for an active, healthy life” (Reutlinger 1986, chap 2). The 1996 World Food Summit expanded the definition as follows:

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO 2009). This is now the widely accepted definition, which includes food access, availability, food use and stability, and recognition of its importance for health.

The term “food preferences” relates to people’s food choices which have a cultural component that also may affect food security. The term “food preferences” was clarified by the following definitions, to be understood as access to socially and culturally acceptable food that is also consistent with religious practices and ethical values. Food security involves not only the ready availability of nutritionally adequate and safe foods, but also an ability to obtain food in socially acceptable ways (without resorting to emergency food supplies, or participating in activities such as stealing, scavenging and other coping strategies) (Anderson 1990). Hamm and Bellows added to the above definition - community food security is a situation in which all community residents obtain a culturally acceptable diet that maximizes community self-reliance and social justice (2003, p. 37). These definitions focus on food security as a situation that refers to individuals, households or communities being able to access and acquire appropriate, healthy, and culturally acceptable food on a reliable basis, and using personally or socially acceptable means.

The preceding definitions have expanded the understanding of the issue of food security, making it necessary to divide the concept into a number of dimensions: food availability, food access, food utilization and stability.

- **Food availability**: the extent to which appropriate levels of food are available, with such food meeting standards of quality as developed through domestic production, imports and food aid (FAO 2006).
- **Food access**: the extent to which individuals can access the necessary resources for ensuring an appropriate level of nutrition in their diets. These are known as entitlements, which are simply the commodities through which a person can utilise legal, political, economic and social resources within their community, including access to traditional resources (FAO 2006).
- **Utilisation**: the ability to use food through necessary diet, water, sanitation and health care in order to create nutritional well-being based on meeting physiological requirements. This points to the role of non-food inputs in food security (FAO 2006).
- **Stability**: the extent to which a population, individual or household can access appropriate food all of the time, without facing risk of restricted access to food in relation to unexpected and immediate events and crises, or cyclical events. Stability is, therefore, related to questions of both availability and access of food security (FAO 2006).

It can be understood from these dimensions that achievement of food security among households can occur by: making food available to people; providing easy access to food and ensuring food is prepared properly; and then ensuring stability of this

process. These concepts reflect a broadening in the understanding of food, health and society.

In contrast to the concept of food security, one of the primary definitions of **food insecurity** was provided by the Life Sciences Research Office, USA in 1990 as: "whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain" (Anderson 1990, p. 1576). Similarly, the definition of the American Dietetic Association focuses on social aspects of food (Kendall and Kennedy 1998, pp 337).

Hunger does not necessarily describe food insecurity. The following definition clarifies that food insecurity can refer to

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; anxiety about acquiring food; or having to rely on food relief (Rychetnik et al. 2003). However, hunger can be understood as a painful physiological feeling due to lack of food, and may be a consequence of food insecurity and is understood as the severest form of food insecurity (Anderson 1990).

There are global initiatives to tackle the ongoing problem of world hunger. The 1996 World Food Summit, as well as the Millennium Summit in 2000 reaffirmed to halve the proportion of people suffering from hunger from 20 to 10% by 2015 (FAO 2013). Currently the world reached this goal where, in developing regions from 1990 to 2010 the proportion of people living on less than $1.25 a day fell from 47% to 22% (United Nations 2013b). Also, the world's number of undernourished people fell

from 18.6% to 12.5% of the world's population between 1990-2002 and 2010-2012 (FAO 2011; Von Grebmer et al. 2012). In addition, chronic hunger among the world's population in years 2011–2013 was 12% (842 million people) 26 million fewer than the number reported in preceding years 1990–92 (1.015 million) (United Nations 2013b). However, further work is needed to ensure people across the globe are food secure.

The most commonly used food security definition in current use is the one stated in the World Food Summit 1996. This definition has been accepted and agreed upon by many government organisations such as the US Department of Agriculture and the Canadian Food Security Bureau (FAO 2009). However, the definitions of food insecurity from the Life Sciences Research Office, USA (Anderson 1990) and the American Dietetic Association (Kendall et al. 1998) are also important to this review because they emphasise more encompassing dimensions of food insecurity including the ability to acquire food, availability of food, nutritional factors, and the social aspects of food. To summarise, food insecurity is not only a lack of quality and quantity of food but also includes the psychological and cultural factors associated with food.

2. 3 Food availability and access as determinants of food security

Achieving food security depends on the availability of and adequate access to the food supply. The importance of these two concepts will be separately explored.

2.3.1 Food supply (availability):

Various aspects of the food supply system can influence food security. These aspects include the location of food outlets, both for retail and processed foods within a community; the availability of food within those stores; the quality, price and variety of the food that is available; and promotion strategies for various food types. These aspects will now be considered in more detail.

2.3.1.1 Location of food outlets and availability of food

Food security, particularly among disadvantaged groups, can be heavily influenced by the location of food outlets that offer a range of affordable foods and people's abilities to access them. Williams et al (2004) showed that type and location of food outlets have an effect on food price. Food outlet types include outlets of pre-prepared food, food markets, local food gardens, food delivery businesses and food retail stores. The local food supply should provide a wide range of choices to encourage the selection of variety and appropriate food (McComb et al. 2000). Ability to access food stores varies with the different kinds of store (Powell et al. 2007). For instance, small independent food stores tend to be more expensive and offer a more limited range of foods and often have limited healthy options, yet such stores might play an important role for consumers with low income and limited access to transportation, when located in locations convenient to communities (Gittelsohn et al. 2012). In general, larger food stores and local supermarkets offer competitive prices, healthful foods and a range of foods which can contribute to household food security (Larson et al. 2009). Thus, food security can be affected by the location of supermarkets in areas where most people live or that are easily accessed by using public transport. However, large supermarkets also contain unhealthy food (Dixon et al. 2006)

2.3.1.2 Quality and price

A local food supply should achieve acceptable standards of quality and affordability with competitive prices (Rychetnik et al. 2003; James et al. 2007). Food quality includes the nutritional value, flavour and appearance of food. Food security might be hindered by the fact that good quality food is available, but more expensive (Rychetnik et al. 2003).

In Australia there is no national monitoring of healthy food prices. However, monitoring of the price of healthy food baskets is an accepted method used by most states and territories to examine cost of food (but with differences in measurement methods). In Queensland, the Healthy Food Access Basket (HFAB) includes food items that meet 70% of nutritional and 95% of the energy requirements for two weeks of a family of six (Wardle et al. 2002a). Research suggests the price of healthy foods has been rising. The cost of the HFAB in Queensland has increased by 6.1% from 2004 to 2006, this potentially increasing the risk of food insecurity as a result of increasing food prices (AVCC 2007). The Illawarra region of New South Wales (NSW) used Illawarra Health Food Basket Index (IHFBI), which is similar to the Queensland HFAB. It was established in 2000 to monitor the cost of 57 food items that met the weekly nutritional requirements of a family of five. The cost of IHFBI had risen by 20.4% between 2000 - 2007 but it was less than the increase of the Consumer Price Index (CPI) (31.9%) for food in the same period (Williams et al. 2009). However, the cost of some food items, for example fruit, rose at a higher rate of CPI (Williams 2010). Unlike the results for Queensland, the IHFBI survey was

only applied in one region and thus did not reveal the situation in the whole of the state of New South Wales.

2.3.1.3 Variety of food and promotion strategies for various food types

Availability of a range of food choices and eating a wide variety of foods influence achieving a nutritious diet. Promotion strategies for various food types in store and in takeaways can encourage the selection of healthy food (Rychetnik et al. 2003).

2.3.2 Food access

To assess whether people have adequate access to food it is important to consider a number of factors, such as: distance and transport to food; their ability to buy food and issues of knowledge and ability to make informed choices; mobility and social support in relation to shopping and preparing food, questions of time, food preferences, preparation and cooking facilities in the home; and considerations of storage.

2.3.2.1 Distance and transport to shops

Distance and transport to shops or supermarkets are important influences on access to food. People living in areas that are poorly serviced by public transport and are located away from supermarkets may struggle to access cheap and good quality food, which will impact on their food security (Rychetnik et al. 2003). Additionally, many low income groups use small local food stores due to lack of transport to supermarkets (Williams et al. 2004). The importance of the automobile to access a range of healthy and preferred foods with convenience at affordable prices has been

reported among low income households residing in Austin, Texas US (Clifton 2004). Similarly, in England low-income groups who used public transport were more likely to buy from local food stores than superstores compared with groups who had their own transport (Robinson et al. 2000). Distance and transportation resources to food shops remain critical factors which may hinder the acquisition of healthy and affordable foods.

2.3.2.2 Financial resources, knowledge and skills

To access a healthy diet enough money is necessary to buy and select good quality food. When money is scarce, food purchasing is prioritised below utilities or rent (Olson and Holben 2002). Students who accessed a food bank at the University of Lethbridge reported that meeting their tuition fees was one of the top priorities (Nugent 2011).

Knowledge and skills need to be taken into account in relation to selecting healthy food and preparing healthy meals, in particular with limited funds (McComb et al. 2000; Rychetnik et al. 2003). However, without consideration for the skills to prepare acceptable foods and knowledge to identify healthy food choices, food security will be difficult to accomplish. Description and measurement of such necessary skills and knowledge has not been reported in the literature in relation to their relative importance in impacting on food security status.

2.3.2.3 Mobility, social supports and time

Poor physical mobility is an obstacle to food security since it inhibits individuals from preparing and purchasing food. In addition, people with limited social support may not have assistance to prepare or cook meals. Inadequate time for shopping or for preparing meals can also be a significant barrier to access a healthy diet, (Maxwell et al. 1992; Rychetnik et al. 2003) in particular for full-time students who live without social support. For example, among Australian and New Zealand populations psychosocial factors including unavailability of time and burden of family and work needs impact on people's ability to achieve healthy food choices (Tapsell et al. 2011).

2.3.2.4 Food preferences

Individual preferences are potentially an obstacle to food security. Food preferences need to be considered in terms of food that is available or being recommended. For example, people from different cultural backgrounds with exactly the same physical food access may not be equally food secure due to diversity in culture or religious limitations related to foods that are appropriate to consume (Barrett et al. 2010).

2.3.2.5 Cooking facilities and storage facilities

An appropriate place to prepare meals is important for eating a healthy diet, especially for limited budget groups, as home preparation of meals frequently is cheaper than buying ready prepared food and often may be of higher nutritional quality. Adequate space and equipment to store food to keep it hygienic and of a good quality has also been identified by several researchers as important factors to

achieve food security (Rychetnik et al. 2003; Vozoris and Tarasuk 2003; Clifton 2004).

In summary, access to a diverse range of safe, preferred, affordable and healthy food and adequate mobility are important factors to facilitate appropriate levels of food security. Economic constraints are important but they are not the only factors that influence food insecurity.

2. 4 Prevalence of food insecurity

Hunger and food poverty are most frequently considered as issues linked with poor and developing countries. However, food insecurity is present in some groups in all developed countries. This section will describe the overall picture of food insecurity in developed nations, within some groups in Australia, and among university students.

2.4.1 Food insecurity in developed countries

Generally, the developed countries are food secure, but issues related to poverty and income lead to appearance of food insecurity among some groups. The most food-secure countries in the world are the United States, Norway, France, Austria, Switzerland, and the Netherlands, as ranked by the Global Food Security Index (GFSI) in 2013 (Global Food Security Index 2013). The GFSI is measured and analysed under three categories: nutritional value and safety, affordability, and availability. Each category is further divided into a series of indicators. The overall score for the GFSI is calculated from a simple weighted average of the category and

indicator scores. The index is scaled from 0 to100, where 100 is the most affirmative (Global Food Security Index 2013).

The United States (US) is a food-rich country and overall is food secure as a nation. Nevertheless, between the years 1998 and 2006 over 10% of US households were reported as being food insecure (Chen et al. 2009). More than 10 million households in the US were food insecure. In 2010 Coleman-Jensen and colleagues reported that 17.2 million U.S. households (14.5 %) were food insecure at some time during the year (Coleman-Jensen et al. 2011). The situation in 2012 has been relatively stable: The US Department of Agriculture (USDA) found that the prevalence of food insecurity was 14.5% including approximately 6% with a severe level of food insecurity (Alisha et al. 2013). This prevalence applied to long term residents in a range of circumstances, with some sub-groups more affected, such as refugees and migrants, which will be discussed in more detail in section 2.4.3. In Canada 2007-2008 the prevalence of food insecurity was reported as 7.7% among Canadian households, with 2.7% severely food insecure (Health Canada 2012).

The United Kingdom ranks 20th globally and the lowest among the Western European countries in terms of food security (Global Food Security Index 2012). It was behind Germany, France, Italy and others. In another study it was found that in England 20% of people attending general medical practices were food insecure without hunger and 6% were food insecure with hunger (Tingay et al. 2003).

In New Zealand, based on responses to eight questions concerning food security, the 2008-2009 nutrition survey reported 7.3% of households were classified as low level

food secure, 33.7% were classified as having moderate food security and only 59.1% were food secure (Ministry of Health 2011). Compared to the findings of the 1997 nutrition survey, the proportion of people who were food insecure had worsened, where 72% of households were food secure, 23.7% moderately food secure and 4.3% had low food security (Stevenson 2012).

In Australia the prevalence of food insecurity measured at the national level has been relatively stable over a number of years. The Australian National Nutrition Survey (NNS) in 1995 (Rychetnik et al. 2003; ABS 2011) included a question related to food insecurity, which was 'In the last 12 months, were there any times that you ran out of food and couldn't afford to buy any more?' For adults (> 19yrs) 5.2% answered 'yes' to this question, with the highest rates recorded among men and women aged 19-24 years, unemployed and those paying rent (Temple 2008). The findings from the 2004-2005 National Health Survey (Temple 2008) were similar (5.1%). In NSW the Health Survey included the same question of adults (> 16yrs) through the years 2002 to 2009. The percentages ranged between 4.4% to 6.1% during that time period, with a higher percentage of food insecurity among females than males throughout the study period (NSW Health 2009). In the population of South Australia, the prevalence of food insecurity was found to be 7.0% through 2000 to 2007 (Foley et al. 2009).

All of the above Australian studies measured food security by the single item question, which gives only an overview of food insecurity without distinguishing between food insecurity severity or extent. Nolan and colleagues conducted a study in 2006 in Sydney comparing the single item measure and the US Food Security

Survey Module (FSSM) (Nolan et al. 2006). The study sought to determine the prevalence of food insecurity within three socially disadvantaged localities in Sydney, Australia in readiness for a local health promotion response. The cross-sectional study utilized a random sample of households from each of the three lowest economically ranked postcodes within the most disadvantaged local government areas (LGAs) in south-western Sydney, using the Socio-Economic Index for Areas 2001 Census data (SEIFA) (Nolan et al. 2006). The researchers utilized interviews incorporating demographic questions, as well as questions regarding transport as related to food procurement. The outcome of using the single-item Australian tool to measure food insecurity indicated that it was specific but insensitive when compared to the 16 item US tool, because the single item Australian tool indicated overall food insecurity prevalence of 15.8%, lower than food insecurity as measured by the 16 item US tool of 21.9%. This result indicates that the previous studies using the single food security item may obscure the actual situation of food insecurity in Australia. Table 2.1 summarizes the overall prevalence of food insecurity of some Australian studies in relation to the instrument used.

Table 2.1 Prevalence of food insecurity in Australia

Studies	Single item (%)	Multi item (%)	Years	References
NNS	(5.2)	N/A	1995	(Temple 2008)
NNS	(5.1)	N/A	2004-2005	(Temple 2008)
NSWHS	(5.7) (6.1) (5.7) (5.3) (5.6) (4.4) (5.1) (4.8)	N/A	2002 2003 2004 2005 2006 2007 2008 2009	(NSW Health 2009)
Sydney	(15.8)	(21.9)*	2006	(Nolan et al. 2006)
South Australia	(7.0)	N/A	2000- 2007	(Foley et al. 2009)
Brisbane	N/A	(25)*	2009	(Ramsey et al. 2012)

*Research conducted among disadvantaged groups.

Generally, lack of food availability is not a problem associated with developed countries. Hence the issue of food security in developed countries is less likely to be about availability of food and more likely to relate to issues of poverty and income.

2.4.2 Disadvantaged populations and food insecurity

Food insecurity and problems with access to or availability of food have been reported to be more frequently observed in communities that are: socioeconomically disadvantaged; have low incomes; lack secure accommodation; are geographically isolated or marginalised in remote areas; and/or live in residential areas with limited food stores and public transport services (Nolan et al. 2006; Coveney 2007; Hadley et al. 2007). In 2009 an Australian study showed that the prevalence of food insecurity among adults residing in disadvantaged urban areas (Brisbane) was 25% using the US Department of Agriculture Food Security Survey Module (USDA-FSSM) (Ramsey et al. 2012).

The most recent report by Anglicare Australia also supported that the high prevalence of food insecurity is in disadvantaged areas. They reported that 76% among 600 people seeking assistance from Anglicare have experienced severe food insecurity. The vulnerable groups were people with low income, renting, unemployed, single parents and single people generally (King et al. 2012). Particular groups of people from non-English speaking backgrounds (for example refugee and asylum seeker communities), elderly people and those affected by compulsive behaviours and substance abuse are particularly vulnerable to food insecurity (Coveney 2007). However, other data show elderly people have lower levels of food insecurity (2.8%) compared to adults aged less than 55 years (7%) (Temple 2006). Without the regular application of consistent and standardised data collection methods that monitor food security status, it is not possible to accurately describe who is at most risk of food insecurity.

2.4.3 Food insecurity among selected disadvantaged groups (immigrants and refugees)

In 2013, 3.2% of the world's population was born in a country different from where they currently lived (United Nations 2013a). The number of international migrants worldwide in 1990 and 2000 were 154, 174 million respectively, however, in 2013 the number reached 232 million (United Nations 2013c). While the highest number of international immigrants was recorded in the US, Australia registered a greater percentage of immigrants relative to the nation's population (19.93% compared to 12.81% for the US) (NationMaster 2011). Refugees and immigrants originate from countries in which both the food supply and domestic purchasing patterns are likely to be different to those in Australia (Assets 2001).

Immigrants are people who choose to resettle to another country, such as workers. However, refugees are people who have been forced to flee their home country. Refugees are usually considered the more disadvantaged. Nevertheless, experiences and characteristics that are linked to food insecurity, such as language barriers and adaptation to a new cultural environment, may overlap between immigrants and refugees (Modarresi Ghavami 2013).

Refugees face particular food security challenges, mostly in the period soon after arrival in a new country. In the U.S, the prevalence of food insecurity among refugees was associated with the length of their stay. Refugees initially faced high levels of food insecurity (73%), especially during the first year. The prevalence declined for those who had been in the US for three years to approximately half of the households (53%) (Hadley et al. 2007). The study also indicated that measures of acculturation such as difficulty in the shopping environment and language were associated with food insecurity (Hadley et al. 2007).

Consultations regarding food insecurity and their experiences after arrival in Australia have been undertaken with refugees in Western Australia (WA) through the 'Good Food For New Arrivals' program (Burns et al. 2000). Data indicated that refugees experienced difficulty sourcing cheap supplies of their traditional foods, including locating *halal* meat and correct identification of permitted *halal* foods. In addition, refugees reported that Australian food tastes were different and lacked freshness. Respondents expressed concerns about chemicals in foods, as well as the costs of familiar food. They experienced difficulty making adjustments to their

shopping habits from daily to weekly shopping trips, as well as adjustments to the timing of their main meal. There was a lack of familiarity concerning local Australian produce, and many respondents found they ran out of food quickly (Burns et al. 2000). Some of these food security issues also may be relevant for international students in Australia.

2.4.4 Food insecurity among university students

University students may be vulnerable to food insecurity because they are at risk of poverty and financial stress (Meldrum and Willows 2006; Forbes-Mewett et al. 2009). Food insecurity may impact on their academic performance. There is little published research that indicates the extent, determinants or consequences of food insecurity in college or university populations. However, findings from multiple studies among children of various age groups demonstrated that food insecurity has potential negative effects on their academic performance (Murphy et al. 1998; Jyoti et al. 2005). Issues of food insecurity among university students in affluent societies will now be reviewed in this section.

The Australian national survey of students conducted in 2006 found that university students were suffering poverty and financial stress, key issues that other studies suggest may be associated with food insecurity (AVCC 2007). In 1991, the University of Alberta in Canada opened a Campus Food Bank in response to the growing problem of student hunger on campus. The Food Bank reported that since its inception there had been a steady increase in its use by students (Rondeau 2007). An exploratory qualitative study among university students in Canada (n=15) studied the perspectives and experiences of food insecurity among students who accessed a

campus food bank. Participants were full-time students, were able to speak and read English and included students with children. During the seven months of the study the food bank provided 107 single and 25 family food baskets to students. The participants' mean age was 26.8 years and the majority were at an undergraduate level. Students described a range of burdens and concerns including: maintaining their academic performance; part-time work; family, religious beliefs and cultural values; and for female students, pregnancies and breast feeding. The students used a range of strategies to cope with their food insecurity status including budgeting funds for the year, purchasing from the cheapest shops, not missing opportunities of free food provided by university or support systems, and storing foods (Nugent 2011).

Additionally, university students in other developed economies have been found to be vulnerable to food insecurity. For example, food insecurity has been reported as a significant problem among a sample of college students (n= 441) at the University of Hawai'i at Mānoa, using the US Food Security Survey Module (FSSM), with 21% reported as suffering from food insecurity and 24% at risk of food insecurity. The vulnerable groups were those living on campus and those living off-campus in shared rooms, compared to those students living with their families. Participation in a campus meal plan did not differ significantly between students who were food secure and food insecure (Chaparro et al. 2009).

A recent cross-sectional study was conducted among college students in a rural university in Oregon in 2011. The study used the short form (6 items) of the US Department of Agriculture food security scale which does not include questions about children's food insecurity nor the most severe adult food insecurity. Fifty nine

percent of the students were food insecure at some point, which was associated with students having low income, having fair or poor health, being employed, and students participating in food assistance programs. However, food insecurity was inversely associated with the good academic performance of the students. Prevalence of food insecurity in both studies was higher than that of the general populations (Patton-López et al. 2014).

International students from different cultural backgrounds have different food patterns. They may try to consume traditional food as a way of retaining their cultural identity. While pursuing study and work based goals, international students are required to simultaneously focus on their health, and the costs and availability of preferred food choices (Assets 2001). International students face difficulties during the early period of living in a foreign country, which may have an adverse impact on long-term health and well-being. For example, interviews with 200 international students across nine Australian universities reported that a significant number of international students experienced serious financial problems (Forbes-Mewett et al. 2009).

In the UK, students from over thirty-six nationalities who were enrolled in a Master's degree (n = 228), reported changes in the consumption of some food groups and in the number of meals consumed. As shown in Table 2.2, overall it was observed that Asian students significantly reduced the number of breakfasts and main meals consumed. Similarly, for European students, the number of main meals consumed was reduced. Therefore, changes in eating habits among the sample of international students were not significantly different (Edwards et al. 2010).

Table 2.2 Mean number of meals before commencing university and since arrival (UK study)

Meal	***Asian***		***European***	
	Mean	SD	Mean	SD
Breakfasts per week				
Before university	4.34[a]	2.51	4.93	2.15
After arrival	3.98[a]	2.33	4.89	2.28
Meals per day				
Before university	2.21[b]	1.02	1.80[c]	0.78
After arrival	1.95[b]	0.87	1.47[c]	0.70

Superscript letters [(a,b,c)] indicate a significant difference ($p \leq 0.05$) in columns.

(Edwards et al. 2010, Table 6, p. 306)

Another aspect of food consumption that may influence international students' eating patterns is food neophobia: the reluctance to eat unfamiliar foods, or the avoidance of such foods (Pliner and Hobden 1992). The food neophobia scores assessed by a scale which includes 10 statements that are rated on a 7-point scale with descriptors ranging from ''agree strongly" to ''disagree strongly" (Edwards et al. 2010) also found that international students' overall food neophobia scores increased from a mean initial value of approximately 28 to 34 three months after their arrival (Edwards et al. 2010). These studies suggested that food security of international students may be affected by unwillingness to try novel foods in their new country. Some level of food neophobia may also be expected in young people living away

from home for the first time, in unfamiliar circumstances, but this has not been explored in the literature.

For international students (n = 235) studying in Belgium from over sixty countries, more than 85% reported having made dietary changes since their arrival (Perez-Cueto et al. 2009). A majority of the students (65%) reported they did not receive any information about healthy eating in their new living environment, but the study did find the majority of the students considered a healthy diet important (Perez-Cueto et al. 2009).

In Australia food insecurity has been identified as an important nutrition issue for both domestic and international students. A study conducted at the University of Queensland surveying 399 students (Hughes et al. 2011) found that the prevalence of food insecurity among students was 12.7%, based on a single question derived from the NNS. However, when data from a multi item questionnaire taken from the USDA were considered in the same study, 46.5% of the sample population was food insecure without hunger, whilst a further 25.3% experienced food insecurity with hunger. Among the domestic students the single item measure was 13.6% food insecure, while using multi item measures yielded much higher rates of 70.1% food insecurity. The situation for international students was worse, with a prevalence of 76.5% of food insecurity using the multi item measures (see Table 2.3) (Hughes et al. 2011). Additionally, students who cooked most food themselves were more likely to be food insecure than students who had someone cooking their food (Hughes et al. 2011).

Table 2.3 Food insecurity among students in Australia

Factors	Total (n)	Food insecurity			Total of multi item results
		Single item (%)	Multi item (%)		
			Without hunger	With hunger	
Total students	399	(12.7)	(46.5)	(25.3)	**(71.8)**
Domestic students	273	(13.6)	(43.2)	(26.9)	(70.1)
International students	116	(10.3)	(54.8)	(21.7)	(76.5)

Adapted from (Hughes et al. 2011, Table no 2 and page no. 30)

2. 5 University students' financial situation

The financial status of university students may affect their food security status. In the first half of 2012 the total number of domestic and international students enrolled at Australian higher education providers was 1,094,672, with domestic students comprising 75.9% (831,391) of all students (DIISRTE 2012). A national survey of students has been undertaken since the mid-1970s and is administered every six years by the Australian Vice-Chancellor's Committee to investigate the financial situations of Australian domestic students. In 2006 thirty seven public Australian universities participated in this survey and the results showed that students' financial status had declined since 2000 (AVCC 2007). In 2012, for the first time, the Student Finances Survey included international students to give a comprehensive assessment of student living standards (Universities Australia 2012). The findings for the first half of 2012 indicated low socioeconomic status occurred among domestic and international students for more than 129,000 students. This finding indicates a need to discuss how to aid students in their financial difficulties and protect them from being food insecure.

The problem of students in financial difficulties has not been resolved and as seen by the statistics above, is continuing to rise. In Canada the number of postsecondary students who were receiving loans for study have increased and many students potentially had inadequate funds to finance their basic dietary needs (Rondeau 2007). Similarly, a study conducted at the University of Alberta found that students reliant on financial aid and living away from home were at risk of food insecurity and had inadequate funds for a nutritionally adequate diet (Meldrum et al. 2006). Also, in a rural university in the USA, food insecurity referred to the poor economic status that college students are facing (Patton-López et al. 2014). Those researchers have concluded that evidence existed to suggest university students who were receiving loans might be at risk of food insecurity and they recommended that an allocation of special financial assistance for food in students' loans is necessary (Meldrum et al. 2006; Rondeau 2007). The recent global financial and food crises created an unprecedented rise in the food insecurity in the world (FAO 2009) and may affect student populations who are already in financially stressed situations. This is reflected in Australian universities.

In the Australian context, results from studies have findings consistent with those from overseas. A Queensland study (Hughes et al. 2011) suggested that university students were at significant risk of food insecurity as a product of limited financial support and inadequate financial access to healthy food. Similarly, a recent survey conducted in Canberra by Anglicare (a charity organisation of the Anglican Church) with more than 200 of the tertiary students from a number of universities and academic institutions showed that food security was a problem for students. An

overwhelming number (87%) reported experiencing some kind of housing stress and 28% of the student sample could not regularly pay for food (there are no details in the article about how food insecurity was measured) (Macalintal 2013). Recommendations made in other countries to address food insecurity, for example food stamps, student price cards (SPC) and food banks, have not been used in Australia. Overall, the evidence shows that tertiary students who experience financial stress may be susceptible to high levels of food insecurity.

2. 6 Diet and health outcomes related to food insecurity

Food insecurity has been found to affect health directly or indirectly through diet quality. The Public Health Association of Australia has called for a national integrated food policy to ensure more affordability and accessibility of healthy nutritious foods for all in rural and remote areas (PHAA 2012). Adults who suffer food insecurity usually consume fewer servings of vegetables, fruits, and dairy and lower levels of micronutrients, such as B complex vitamins, magnesium, zinc, iron, and calcium (Lee and Frongillo 2001). Additionally, poor diet has been identified as the leading contributor to the burden of disease (Murray and Lopez 2013). Also, in New Zealand the substantial increase of food insecurity was linked with the increase of the weight status of the NZ population, unhealthy food choices and low intake of essential nutrients (Stevenson 2012). According to data from the National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of the US civilian population, these dietary patterns are associated with the development of chronic diseases, including diabetes, hyperlipidemia, and hypertension (Seligman et al. 2010).

Food insecurity is an obstacle that threatens physical and mental well-being. The global food security crisis has had negative health impacts on the lives of millions of people, such as increased malnutrition; communicable and noncommunicable diseases; impaired mental development; diminished learning ability; and increased prevalence of chronic diseases, anaemia and other micronutrient deficiency conditions; mortality and morbidity especially among women and children (WHO 2011). Research has found that food-insecure households are more likely to have poor mental health, high stress, a very weak sense of community belonging, and high dissatisfaction in life, compared with their counterparts in food-secure households (Mathews et al. 2010; Willows et al. 2011). Furthermore, a study conducted in Taiwan reported that children living in food insecure households were considerably more likely to have iron deficiency anaemia, diabetes, endocrine disorders, inherited disorders of metabolism, mental disorders, as well as ill-defined symptoms relevant to nutrition, metabolism and development (Chen et al. 2009). In the case of students affected by food insecurity, it may have negative effects on their diet, health and potentially their academic achievement.

2. 7 Associations between low socio-economic status, obesity and food insecurity

The paradox in food security is that there is a link between poverty, food insecurity, obesity and being overweight. Food-insecure groups are more likely to eat higher amounts of cheaper and convenience foods and these foods have high fat, salt and sugar content (Block et al. 2004) and hence provide less nutritional quality. A review study noted the association between food insecurity and obesity in people aged over 18 years (in women more than men) but not in children (Dinour et al. 2007). While it

is not the purpose of this study to investigate obesity, it is interesting to note that university students are located within this age group with a likelihood of obtaining cheap convenience food. There is also evidence that during the young adult years, there is a period of rapid weight gain (Hebden et al. 2012), so it is important to address factors which may contribute to increased weight status.

In the UK, researchers measured the risk of obesity by occupation, education (two markers of economic status) and receipt of benefits (Wardle et al. 2002b). This study revealed that after adjusting for age, marital status and ethnicity, for both males and females, the risk of obesity was 40% higher for those in receipt of benefits. Additionally, a commissioned report demonstrated the risk of obesity was approximately 40% higher in those low income women experiencing food insecurity. This was observed across Australia, Europe and the United States (Burns 2004). A study in South Australia among a young homeless population suggested that limited food access had a potential effect on weight and nutrient intake (Booth 2006). This was explained by other studies that have linked homeless people being overweight to irregular periods of hunger and overeating when food is available (Bouvier 2008; Smith and Richards 2008). Barriers to achieve food security for university students may depend on how they manage their budget and set their spending priorities.

2. 8 Conclusion

The concept of food security has expanded in recent times, and now encompasses not only the energy adequacy and nutritional requirements of people, but also food-related aspects of their physical and mental well-being. Food insecurity is not only a

problem associated with developing countries but it also exists in developed countries, especially among vulnerable groups.

This literature review has highlighted the importance of understanding the financial elements associated with tertiary students. This is particularly relevant to this research because it highlights some of the additional dimensions experienced by university students in accessing food and food security. Although limited in scope, existing research suggests that university students in Australia experience food insecurity at disproportionately higher rates than the general Australian population (13% vs 5%, using the single item question) (Temple 2008; Hughes et al. 2011).

The literature has shown that many previous studies using the single item measure have reported lower rates of food insecurity, potentially because the one item focuses only on economic factors. However, more information is required to assess the full dimensions of food insecurity. Hence, this study will use both single and multi item measures to explore food insecurity in university students' context. Also highlighted in the current literature has been the potential negative influence on food security of unfamiliar food for refugees and immigrants; these food security issues may be relevant for international students. Additionally, the literature has shown that food insecurity is also a problem among domestic students.

Numerous studies, both international and Australian, confirm that some groups such as socioeconomically disadvantaged people, immigrants and refugees are more vulnerable to food insecurity. Tertiary students are an additional vulnerable group. There are few published studies undertaken on tertiary students' food insecurity and

their food choices, especially in respect to cultural and religious factors. Therefore, the researchers of the current study found this as an extra area that has not been covered before by the single or multi item measures. Furthermore, the research suggests that international students experience higher rates of food insecurity. This may be due to cultural and socioeconomic factors. It is apparent that only limited research has been specific to food security of university students in Australia. This research project seeks to contribute to the literature by assessing the food security (availability, access and affordability) among students at the University of Wollongong.

3 STUDY DESIGN AND METHOD

3. 1 Introduction

This section briefly describes the overall study method and design. The aim of this study was to investigate the extent of food security among students attending the UOW, and to explore factors associated with food insecurity by using single and multi item measures (food insecurity measures will be discussed in more detail in section 3.4). It was also important to explore factors associated with university students' food insecurity. An anonymous questionnaire was selected to investigate these issues given the sensitivity of the questions. Use of existing validated survey instruments also provided the potential for comparison with other studies. The goal was to include a large number of participants from a range of students. However, richer information about the nature of food insecurity would be provided using qualitative methods, for example semi-structured in-depth interviews, but these were not possible in the present study.

3. 2 Study population and sampling

A total of 24,099 onshore students were enrolled at the University of Wollongong in 2012. Of these students, 12,297 were women and 11,802 were men. Approximately 17,841 were domestic students and 6,258 international students. Campus data were provided by the Strategic Planning and Quality (SPQ) Office of the UOW.

The study aimed to recruit at least 318 students, given the expected prevalence of food insecurity of 46.5% (Hughes et al. 2011) with an alpha value of 0.05. The sample size was calculated for likely proportion using the power calculation tool

National Statistical Service (NSS 2012). This was calculated to provide sufficient power to detect a significant difference between two proportions (e.g. domestic versus international) of 10% difference, at the two-sided 5% significance level.

3. 3 Recruitment

Most student clubs and associations at the UOW were contacted via email to seek their permission to send a voluntary online questionnaire to their student members (see Appendix D). The students were approached initially and informed about the project by sending an invitation email (Appendix E) and a Participant Information Sheet (PIS) through their university email account (Appendix F), together with details of the questionnaire URL. In addition, a number of flyers including details of the research and the questionnaire link were distributed by hand throughout the campus (library, lanes, parking and cafes). Recruitment also occurred by word of mouth directly to invite students (Appendix G). Eleven student groups responded and sent the questionnaire via email to their members and two clubs also uploaded it onto their Facebook pages. Also, it was posted in a personal capacity to the University of Wollongong page and other students' groups pages on Facebook. The students groups are listed in Table 3.2.

Table 3.2 Names of students' groups and methods of their recruitment

Name of groups	**Methods of sending the** questionnaire **link**
Health Sciences Social Club	Email and Facebook (uploaded)
Student Health Alliance for Rural Populations (SHARP)	Email
UOW Red Cross Club	Email
Research Student Centre	Email
Manager of Student Support Advisers	Email
Italian Circle club	Email
Thai Student Association of Wollongong club (TSAW)	Email
Physics Society club	Email
Saudi Students Association club	Facebook (uploaded)
Faculty of Arts Staff and Students Association (FASSA)	Email
Muslim Association of Wollongong University (MAWU)	Email
UOW Student Life Facebook page	Facebook (posted)
UOW Law Students' Society Facebook page	Facebook (posted)
University of Wollongong Facebook page	Facebook (posted)

3. 4 Questionnaire

A cross-sectional online questionnaire of all students enrolled at the UOW was used to collect data through SurveyMonkey software (SurveyMonkey 2013). Student clubs and associations at the UOW were contacted to distribute the questionnaire to their members using students' university email accounts or via Facebook.

A questionnaire was developed regarding access to food and food security. It included 17 items to collect demographic information, 11 questions about food access and buying habits and 15 items measuring food experiences relating to food insecurity in the last 12 months or since they started studying at the university

(Appendix C). The questionnaire questions in this study were derived from food security surveys used in the US (Household Food Security Survey Module (FSSM)) (Bickel et al. 2000), and Australia (Australian National Nutrition Survey (Rychetnik et al. 2003; ABS 2011) and "Food insecurity in three socially disadvantaged localities in Sydney, Australia" (Nolan et al. 2006). The Nolan research also included questions about food access and some of these were used in this research. This will be discussed in more detail in section 3.5.

3. 5 Study tools

3.5.1 Questions used in the questionnaire

The questionnaire developed for this study contains forty three questions including demographic information, food habits, use of support services, transport, accommodation, finances and food experiences related to food insecurity. The questions were derived from a range of sources. Primarily the questions reflected those in the study by Hughes and colleagues in Queensland (Hughes et al. 2011), with slight modifications to accommodate the UOW students and to maintain consistency with other Australian studies. The questionnaire included access to food, in addition to food security, which was different from other instruments used in USA. Sensitive demographic questions, such as employment and income, were placed at the end of the questionnaire because of their sensitivity. An additional question to explore food security in terms of availability of foods that are suitable to meet students' cultural needs, obtained from the New Zealand National Nutrition Survey, asked if the individuals felt stressed about providing food for social occasions (Russell et al. 1999). Such a question was not included in either the US

FSSM questionnaire or Hughes et al 2011 modified version. The questionnaire took approximately 15 minutes to complete.

Multi item measures in this study which measured food insecurity were obtained from 16 items used by FSSM from the United States Department of Agriculture (USDA) Community Food Security Assessment Toolkit. This survey is a uniform national measure that categorises households and individuals as food-secure, or food-insecure at different degrees of severity, and includes household-, adult- and child-food insecurity measure items. The US FSSM has been used since 1995 across the United States, Canada and Australia (Nolan et al. 2006; Chaparro et al. 2009; Hughes et al. 2011). Multi item measures capture food insecurity for multiple domains: anxiety about insufficient food budget or food supply; the experience of running out of food and not having enough money to buy more; instances of reduced food intake by adults or children or both; and the consequences such as weight loss and hunger. This research used 11 items from the 16 in US FSSM. Five of the remaining six questions were about children's food insecurity which is not the main focus of this study. The other question was "Which of these statements best describes the food eaten in your household in the last 12 months: --enough of the kinds of food (I/we) want to eat; --enough, but not always the kinds of food (I/we) want; --sometimes not enough to eat; or, --often not enough to eat?" and its branches were "reasons why people don't always have enough to eat" and "reasons why people don't always have the quality or variety of food: Not enough money for food; Not enough time for shopping or cooking; Too hard to get to the store; On a diet; No working stove available; Not able to cook or eat because of health problems; Kinds of food (I/we)

want not available" (Bickel et al. 2000) which provided information similar to information asked in question 23 and 24 in the current questionnaire.

Food security was further investigated by including the single item question that measured food insecurity from the 1995 Australian National Nutrition Survey (NNS), which has also been used in state based health surveys (NSW Health survey) (NSW Health 2009). The question asks 'In the last 12 months, were there any times that you ran out of food and couldn't afford to buy any more?', which emphasises the economic nature of food insecurity (Rychetnik et al. 2003; ABS 2011).

Two recent surveys conducted in Australia, Hughes et al. (2011) and Nolan et al. (2006), used both single and multi item measures. Hughes and his colleagues measured food insecurity among Australian university students by using eight of the 16 existing items from the FSSM and the single food insecurity question from the NNS. The researchers modified the questions to make them appropriate and relevant for students in Australia (Hughes et al. 2011). In the development of the current UOW study, questions from the research by Nolan et al. (2006) were also used, which investigated the prevalence of food insecurity within three socially disadvantaged localities in Sydney, Australia. Also, the researchers in this study used the food access and availability questions which were used in Nolan et al's study (2006).

In addition to the food security measures, further questions were developed by the researchers of this study to include questions relevant to the study population,

including: special food requirements, including cultural and religious food needs, and food purchasing behaviours.

There are a variety of terms that have been used in the literature to indicate the severity of food insecurity and levels of food insecurity (such as, food insecurity with hunger, food insecurity without hunger) which have been referred to in the literature review section (Hughes et al. 2011). However, some countries, e.g. the USA, also have official guidance as to the terms to be used in their reporting. In this study, the main focus was whether or not students were food insecure. Thus, terms depicting further discrimination of the type or severity of food insecurity (e.g. food insecurity with hunger, food insecurity without hunger) were not used. Similarly, the official USA coding guidelines developed to accompany the FSSM were modified, as there were changes made to the questionnaire (additional questions from different sources) to reflect the circumstances of the cohort under investigation.

Table 3.1 Coding questionnaire responses for the food security measures

Question	Affirmative Responses (Code = 1)	Negative Responses (Code = 2)
In the last 12 months or since you started studying at the university if this is less than 12 months, were there any times that you ran out of food and could not afford to buy more? [A]	Yes	No
When this happened did you go without food? [A]	Yes	No
I feel stressed because I can't provide the food I want for social occasions [B]	Often ; Sometimes	Never
I worry whether my food will run out before I get money to buy more. [B]	Often ; Sometimes	Never
The food that I bought just didn't last, and I didn't have money to get more. [B]	Often ; Sometimes	Never
I couldn't afford to eat balanced meals. [B]	Often ; Sometimes	Never
Did you ever cut the size of your meals or skip meals because there wasn't enough money for food? [C]	Yes	No
How often did this happen? [C]	Almost every month, Some months but not every month	Only 1 or 2 months
Did you ever eat less than you felt you should because there wasn't enough money to buy food? [C]	Yes	No
Were you ever hungry but didn't eat because you couldn't afford enough food? [C]	Yes	No
Did you ever not eat for a whole day because there wasn't enough money for food? [C]	Yes	No
How often did this happen? [C]	Almost every month, Some months but not every month	Only 1 or 2 months
Did you lose weight because you did not have enough money for food? [C]	Yes	No
In the last 12 months, did (your child /any of your children) ever skip meals because there wasn't enough money for food? [C]	Yes	No
My (child was/ children were) not eating enough because I just couldn't afford enough food. [C]	Often true; Sometimes true	Never true
How often did this happen? [C]	Almost every month, Some months but not every month	Only 1 or 2 months
In the last 12 months did (your child/any of the children) ever not eat for a whole day because there wasn't enough money for food? [C]	Yes	No

[A] [B] [C] Indicate questions classification [A] items from the Australian National Health Survey which is used to calculate the prevalence of food security in Australia, [B] multi item measure from USDA, [C] multi item indicate severe food insecurity.

3. 6 Statistical analysis

SPSS (Statistics Premium Grad Pack - Version 21.0 for Microsoft Windows) was used to analyse data gathered from the questionnaires. The statistical methods were checked by two statisticians to ensure that appropriate statistical methods were applied.

Demographic characteristics of the student sample were summarised using descriptive statistics (Frequencies, Crosstabs, Chi-square). Descriptive data analysis included the calculation of overall prevalence of food insecurity among participants using the single and multi item measures. Participants were identified as food insecure if they answered yes to the single item question or yes to any of multi item questions. This was then stratified by demographic attributes such as gender and country of origin. Types of food insecurity were also described, and information about suburb and shopping habits were examined and compared to food security status. Differences between food secure and food insecure individuals were explored using Chi-square tests with a range of socio-demographic, social and environmental variables. Campus data about overall student numbers, gender and nationality were provided by the Strategic Planning and Quality (SPQ) Office of the UOW. As Chi-square tests can identify associations between two variables but do not always provide the value of the odds ratio, univariate analysis was also used to obtain odds ratio for all variables of interest.

Multiple logistic regression analysis assessed likelihood of food insecurity including a number of variables which were significantly associated to food insecurity using the multi item measure as the dependent variable. All variables found statistically

significant in the Chi square tests were separately included and analysed in the multivariate logistic regression. The regression analysis was used to develop models to predict food insecurity status with odds ratios (OR) and 95% confidence intervals. Backward stepwise logistic regression was used to eliminate the non-statistically significant variables from the model. Goodness-of-fit was assessed using the Hosmer - Lemeshow test. Finally, multicollinearity in the logistic regression was tested by examining the standard errors for the β coefficients; crosstab tests were used to investigate any significant collinearity among variables in the models.

In this study, students were classified as having food insecurity at any level if they answered affirmatively (Yes) or 'Often true' or 'sometimes true' or 'Almost every month', 'some months but not every month' to any of the single or multi item questions. Once one or more indicators of adult food insecurity were found, the number of affirmative responses was calculated. Food insecurity was categorised as severe if respondents answered 'yes' to any of a number of questions which indicated reduced food intake and disrupted eating patterns (see Table 3.1). The severity of food insecurity (severe level of food insecurity) was based on the severity rank in the multi item questionnaire from the USDA food security scale (Bickel et al. 2000; Cohen 2002).

3. 7 Ethical considerations

This cross-sectional study received ethics approval number HE12/225 from the University of Wollongong/Illawarra Shoalhaven Local Health District Social Sciences Human Research Ethics Committee (HREC) (see appendix B). A number of ethical issues were considered to protect participants' rights and to ensure that no harmful effects arose as a result of their participation. Participants' privacy was ensured through the anonymity of the questionnaire. In addition, participants could not be identified from the questionnaire (e.g. by address) ensuring the participants remained anonymous throughout the study, even to the researchers themselves. Participation in this research was voluntary. Data (including questionnaire responses and computer data) were securely stored at all times; a copy of the data has been stored on a password protected university computer. The Participant Information Sheet (PIS) was included at the front of the SurveyMonkey questionnaire to explain the purpose of the project and the use of the data that were generated.

4 RESULTS

4. 1 Introduction

This chapter presents the results of the questionnaire, including: the demographic characteristics of the study population; food insecurity status using the single item measure taken from the Australian National Nutrition survey as well as the multi item measure from the US Household Food Security Survey Module; and students' experiences in regard to food access and availability. The chapter firstly presents descriptive statistical results and multivariate results for levels of food insecurity and then presents the descriptive statistical results for food access and purchasing behaviours.

4. 2 The study population

The demographic characteristics of the study population are shown in Table 4.1. A total of 337 students from ten faculties from UOW completed the online questionnaire. The students' ages ranged from 18 to 68 years, with a mean age of 30 years (SD = 9.2). More than half of the students were women and 41.8% were men. Twenty three percent of the study population had children, with the majority of them having one or two children. The majority of participants (92.4%) lived in the Illawarra region; more than two thirds (68.2%) lived in central Wollongong, mostly living in suburbs surrounding the university, with a small number living in more distant locations across the Illawarra, and less than 10% live in Sydney.

Table 4.1 Demographic characteristic of the participants

Factors	Total (n) 337	(%)
Gender		
Male	141	(41.8)
Female	196	(58.2)
Nationality		
Domestic	168	(50.3)
International	166	(49.7)
First language		
English	170	(51.8)
No	158	(48.2)
Period of study		
<12 months	83	(24.7)
1-<2 years	67	(19.9)
2-<3 years	61	(18.2)
3+ years	125	(37.2)
Area of residence		
Illawarra	305	(92.4)
Sydney	25	(7.6)
Faculties		
Health Sciences, Medicine.	151	(45.5)
Arts, Creative Arts, Law.	89	(26.8)
Sydney Business School, Commerce	40	(12.0)
Engineering, Informatics.	29	(8.7)
Education	23	(6.9)
Type of study		
Under/ Post-graduate coursework	171	(51.4)
Post-graduate research	162	(48.6)
Age groups		
18 – 24	103	(31.1)
25 – 34	143	(43.4)
35 +	85	(25.7)
Living arrangement		
Household with no children	137	(40.7)
Household with dependent children	38	(24.6)
Group, unrelated adults (house/flat mates)	111	(32.9)
Number of people		
0-1	34	(10.5)
2-5	256	(78.8)
6+	35	(10.8)
No. Children *(Missing data 189)*		
0	70	(47.3)
1	33	(22.3)
2	29	(19.6)
>2	16	(10.8)
Country of origin		
Asia	82	(49.4)
Middle East	56	(33.7)
Europe	12	(7.2)
North America	11	(6.6)
South America	3	(1.8)
Other countries*	2	(1.2)

* Fiji, Nigeria

The majority of the students who completed the questionnaire had been enrolled for less than three years. Half of the students were from Australia. Of the international students, the majority came from Asia and the Middle East. Note that Asia includes China, South East Asia and India. Figure 4.1 shows the study population by region of origin. Half of the students reported that English was their first language while almost half (48.2%) reported other languages, reflecting their countries of origin.

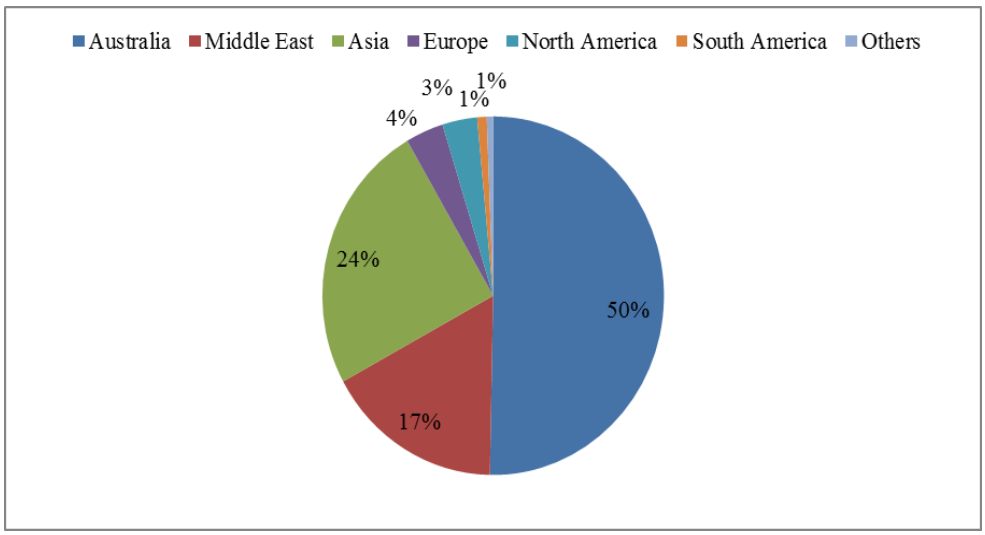

Figure 4.1 Distribution of students according to their area of origin

International students' and domestic students' demographic variables proved to be significantly different except in terms of their study type (coursework or research). Most international students (59.3%) were aged from 25 to 34 years, while domestic students were younger (18 to 24 years). International students were less likely to be living with a partner or parents compared with domestic students (57% domestic vs 40% international, $p = 0.002$), see Table 4.2. In terms of the language, the great majority of domestic students spoke English as their first language compared with few international students who spoke English as their first language (92.2% vs 10.2%, $p < 0.0001$).

Table 4.2 Demographic attributes among domestic and international students

Demographic factors	Total n= 337	(%)	Domestic		International		χ^2 test *P value*
			n	(%)	n	(%)	
Gender							
Male	139	(41.6)	57	(33.9)	82	(49.4)	0.004
Female	195	(58.4)	111	(66.1)	84	(50.6)	
Age groups							
18-24	102	(31.1)	71	(42.8)	31	(19.1)	<0.0001
25-34	142	(43.3)	46	(27.7)	96	(59.3)	
35+	84	(25.6)	49	(29.5)	35	(21.6)	
First Language							
English	170	(52.1)	153	(92.2)	17	(10.6)	<0.0001
Other	156	(47.9)	13	(7.8)	143	(89.4)	
Area of residence							
Illawarra	303	(92.4)	145	(87.9)	158	(96.9)	0.002
Sydney	25	(7.6)	20	(12.1)	5	(3.1)	
Type of study							
Under/Post-graduate coursework	169	(51.1)	83	(49.7)	86	(52.4)	0.618
Post-graduate research	162	(48.9)	84	(50.3)	78	(47.6)	
Living arrangement*[1]							
Household with no children	136	(41.3)	76	(45.5)	60	(37.0)	
Household with dependent children	83	(25.2)	43	(25.7)	40	(24.7)	0.157
Group, unrelated adults	110	(33.4)	48	(28.7)	62	(38.3)	
Living arrangement*[2]							
Live with no partner or parents*[3]	169	(51.4)	72	(43.1)	97	(59.9)	0.002
Live with partner or parents	160	(48.6)	95	(56.9)	65	(40.1)	

*[1] Households categorized according to presence of children
*[2] Households categorized according to family support
*[3]Live alone with dependent children, live alone with no children, live in group household of unrelated adults (house/flat mate)

4.2.1 Students' economic characteristics

The monthly income of 32.7% of the students was less than $1000 per month (see Table 4.3), and 36% of the students had no scholarship and no employment. Among students with a monthly income of less than $1000, 54.8% did not have employment. The average students' working hours per week among those students who had employment (n=129) was 18 hours (SD 16.3), with a range from minimum of one

hour to maximum of 80 hours. Twenty three percent of students worked more than 20 hours per week.

Table 4.3 Students' economic factors

Factors	**Total (n) 337**	**(%)**
Employment status		
Yes	129	(41.0)
No	186	(59.0)
Income/month		
< $1000	93	(32.7)
$ 1000- $ 4999	169	(59.5)
$ 5000- $ 9000+	22	(7.7)
Scholarship		
Yes	178	(53.5)
No	155	(46.5)
Scholarship type		
University fee paying only	21	(13.6)
University fee and living expenses	112	(72.7)
Living expenses only	21	(13.6)
Housing arrangements		
Rented	204	(61.0)
Rented, university accommodation	43	(12.8)
Paying-off mortgage	35	(10.5)
Living rent free	29	(8.7)
Outright owner or fully owned	23	(6.9)

Table 4.4 shows that there were significant differences between international and domestic students in regard to all economic variables. Differences in the sources of financial support were also evident, with most of the international student respondents having a scholarship (69% vs 39% domestic, $p<0.0001$), while most of the domestic student respondents had employment (60.9% vs 19.6% international, $p<0.0001$). The great majority of international student respondents lived in rented accommodation compared with domestic students (93% vs 54.5%, $p = <0.0001$). On the other hand, almost half of domestic student respondents either owned their home, were buying their home or lived at home with parents or relatives (93.3% vs 45.5%, <0.0001).

Table 4.4 Economic attributes among domestics and international students

Economic factors	Total N= 337	(%)	Domestic		International		χ^2 test *P value*
			n	(%)	n	(%)	
Scholarship							
Yes	178	(53.8)	64	(38.6)	114	(69.1)	<0.0001
No	153	(46.2)	102	(61.4)	51	(30.9)	
Employment							
Yes	128	(40.8)	98	(60.9)	30	(19.6)	<0.0001
No	186	(59.2)	63	(39.1)	123	(80.4)	
Monthly income							
<$1000	93	(32.9)	59	(38.6)	34	(26.2)	<0.0001
$1000-$4999	168	(59.4)	76	(49.7)	92	(70.8)	
$5000- $9000+	22	(7.8)	18	(11.8)	4	(3.1)	
Housing arrangements							
Renting	245	(73.8)	91	(54.5)	154	(93.3)	<0.0001
Other*	87	(26.2)	76	(45.5)	11	(6.7)	

*Own home, buying home, living at home with parents

4.2.2 Sample characteristics

UOW data of students by gender and nationality (domestic and international) were compared with the study data using the *Immediate Chi Square* test. The results indicated that the distribution of student participants in the current study was significantly different in terms of gender, type of study and nationality of all UOW students. This study sample was over-represented by female students (58.2% vs 49% UOW, $p < 0.0001$,) research students (48.6 vs 7.3% UOW, $p < 0.0001$) and international students (49.9% vs 26% UOW, $p < 0.0001$). Campus data were provided by the Strategic Planning and Quality (SPQ) Office of the UOW.

4. 3 Food insecurity status

The following sections illustrate students' food insecurity status using two measures, as has been noted in the methods: the single item measure derived from the NNS, and the multi item tool derived from US FSSM questions, including food insecurity among children in the students' household.

4.3.1 Food insecurity status using the single item measure

Overall, the level of reported food insecurity using the single item question was 19.6% (n = 62). Table 4.5 presents the prevalence of food insecurity using the single and multi item measures in relation to the demographic attributes of the student respondents.

A number of student characteristics were associated with food insecurity as measured by the single question. These factors included study duration, age, living arrangements and type of course. Length of time as a student was significantly linked to food insecurity ($p = 0.003$). Students who had studied less than two years compared to a longer period of study reported a higher percentage of food insecurity (26.1% vs 14.4%%, $p = 0.009$). Students aged less than 35 years old were more likely to be food-insecure compared to those aged 35 and older (22.1% vs 11.8%, $p = 0.050$). Students who studied coursework reported a higher percentage of food insecurity than students doing research (12% vs 26.1%, $p = 0.022$). Students living in group household with house/ flat mates reported a higher percentage of food insecurity (23.9%) than students living in other households, either with children (16.7%) or without children (15.9%). Area of origin did not have any significant difference in terms of food security using single item tool. Note the number of respondents from some areas of origin were very low and did not allow meaningful statistical comparisons.

Table 4.5 Food security status of the sample using single and multi item measures in relation to the demographic attributes

Factors	Food insecurity measure %						χ^2 by single item	χ^2 by Multi item
	FI, single item			FI, multi item				
	Total	n	(%)	Total	n	(%)	*p value*	*p value*
Gender								
Male	130	28	(21.5)	130	82	(63.1)	0.473	0.493
Female	186	34	(18.3)	184	109	(59.2)		
Nationality								
Domestic	161	33	(20.5)	159	82	(51.6)	0.603	0.001
International	154	28	(18.2)	154	108	(69.9)		
First language								
English	162	31	(19.1)	160	85	(53.1)	0.756	0.003
No	146	30	(20.5)	146	102	(69.9)		
Period of study								
<2 years *[1]	142	37	(26.1)	141	101	(71.6)	0.033	0.001
2-<3 years	59	9	(15.3)	59	35	(59.3)		
3+ years	115	16	(13.9)	114	55	(48.2)		
Area of residence								
Illawarra	286	58	(20.3)	284	179	(63.0)	0.796	0.031
Sydney	25	16	(16.0)	25	10	(40.0)		
Faculties								
Arts, Creative Arts, Law	28	3	(10.7)	27	20	(74.1)	0.657	0.025
Sydney Business School, Commerce	37	7	(18.9)	37	24	(64.9)		
Engineering, Informatics	83	16	(19.3)	83	56	(67.5)		
Health Sciences, Medicine	144	32	(22.2)	143	82	(57.3)		
Education*[2]	21	3	(14.3)	21	7	(33.3)		
Type of study								
Under/ Post-graduate coursework	165	43	(26.1)	164	116	(70.7)	0.022	<0.0001
Post-graduate research	150	18	(12.0)	149	74	(49.7)		
Age groups								
18-34 years	235	52	(22.1)	234	152	(65.0)	0.050	0.016
35 + years	76	9	(11.8)	75	37	(49.3)		
Household structure								
Household with no children	126	20	(15.9)	126	70	(55.6)	0.252	0.016
Household with dependent children	78	13	(16.7)	77	41	(53.2)		
Group, unrelated adults*[3]	109	26	(23.9)	108	77	(71.3)		
Number of people								
0-1	30	4	(13.3)	29	17	(58.6)	0.366	0.784
2-6+	277	56	(20.2)	276	169	(61.2)		
Number of Children *among people who have children*							0.444	0.219
1-2	62	13	(21.0)	62	32	(51.6)		
>2	16	2	(12.5)	16	11	(68.8)		
Areas of origin								
Australia*[4]	161	61	(20.5)	159	82	(51.6)	0.416	0.005
Middle East	53	11	(20.8)	53	39	(73.6)		
Asia	74	12	(16.2)	74	53	(71.6)		
Europe	12	2	(16.7)	12	8	(66.7)		
North America	10	1	(10.0)	10	5	(50.0)		
South America	3	2	(66.7)	3	3	(100)		

*[1] $p < 0.05$ cf. to 3+ years for single and multi item.
*[2] $p < 0.05$ cf. to Engineering and Informatics students; and Arts, Creative Arts, Law.
*[3] $p < 0.05$ cf. to household with no children $p = 0.013$ and household with dependent children $p = 0.012$.
*[4] $p < 0.05$ cf. to Middle East and Asian students

Economic status was also an important factor influencing food security status. Students who had a scholarship and those who did not pay rent were more food secure, with significant differences, $p = 0.022$, $p = 0.038$ respectively. Overall, students' monthly income had a significant association with food insecurity $p = 0.019$. In particular, students with less than $1000 monthly income were the most food insecure when compared with those who earned more than $1000 per month (28% vs 15.7%, $p = 0.015$). Comparing the group earning $1000-$4999 with $5000-$9000+ there was no significant difference when using the single item but a significant difference was found with multi item questions (see Table 4.6). There was no significant difference by gender; among domestic versus international students; English and non-English as the first language; area of residence; faculties; living arrangement; number of people living in a household; number of children; area of origin; employment status; special food needs; if food provided by accommodation met their special food needs; transport type or responsibility to purchase own food.

Table 4.6 Food security status of the sample using single and multi item measures in relation to economic factors

Factors	Food insecurity measure %						χ^2 by single item *p value*	χ^2 by Multi item *p value*
	FI, single item			FI, multi item				
	Total	n	(%)	Total	n	(%)		
Employment status								
Yes	129	23	(17.8)	128	63	(49.2)	0.491	0.001
No	186	39	(21.0)	185	127	(68.6)		
Income/month								
< $1000*[1]	93	26	(28.0)	92	70	(76.1)	0.019	<0.0001
$1000- $4999*[2]	169	29	(17.2)	168	91	(54.2)		
$5000- $9000+	22	1	(4.5)	22	3	(13.6)		
Scholarship								
Yes	168	25	(14.9)	168	92	(54.8)	0.022	0.021
No	147	37	(25.2)	145	98	(67.6)		
Housing arrangements								
Renting	232	52	(22.4)	231	160	(69.3)	0.038	<0.0001
Others*[3]	84	10	(11.9)	83	31	(37.3)		

*[1]$p < 0.05$ cf. to $ 1000 – $ 4999 and $ 5000 – 9000 + for single and multi item.
*[2] $p< 0.05$ cf. to $ 5000 - $ 9000 +.
*[3]Own home, buying home, living at home with parents

The data also revealed that experiencing difficulties getting to and from the shops to buy food and not having their own car affected students' food security. Students who reported some level of difficulty getting to the shops compared to those who did not report such difficulties had significantly higher levels of food insecurity (30.6% vs 14.9%, $p = 0.001$) (see Table 4.7).

Reasons given for not obtaining desired quality or variety of food included location of food stores, price of food, quality of food and variety of food had a significant difference as shown in Table 4.7. The results demonstrated that the price of food was an issue among 89.2% of students with less than $1000 monthly income and also among 83.2% of those with $1000- $4999. Even among students with monthly income from $5000 to + $9000, 36.4% of these students considered the price of food as one of the reasons for not obtaining quality or variety of food desired.

Table 4.7 Food security status of the sample using single and multi item measures in relation to food access and availability

Food access and availability factors	Food insecurity measure						χ^2 by single-item *p value*	χ^2 by Multi item *p value*
	FI, single-item			FI, Multi item				
	Total 337	n	(%)	Total 337	n	(%)		
Reasons given for not obtaining quality or variety of food desired								
Location of food stores								
Always/ Occasionally	179	44	(24.6)	179	125	(69.8)	0.19	0.001
Seldom	125	17	(13.6)	124	63	(50.8)		
Price of food								
Always/ Occasionally	252	57	(22.6)	251	171	(68.1)	0.009	<0.0001
Seldom	56	4	(7.1)	56	18	(32.1)		
Availability of healthy food								
Always/ Occasionally	168	39	(23.2)	167	111	(66.5)	0.231	0.078
Seldom	131	17.6	(17.6)	131	74	(56.5)		
Availability of culturally appropriate foods							0.581	0.013
Always/ Occasionally	147	31	(21.1)	147	100	(68.0)		
Seldom	151	28	(18.5)	150	81	(54.0)		
Quality of food								
Always/ Occasionally	220	51	(23.2)	219	148	(67.6)	0.014	<0.0001
Seldom	78	8	(10.3)	78	35	(44.9)		
Variety of food								
Always/ Occasionally	206	47	(22.8)	205	144	(70.2)	0.038	<0.0001
Seldom	89	11	(12.4)	89	38	(42.7)		
Not enough time for shopping or cooking							0.646	0.459
Always/ Occasionally	227	46	(20.3)	226	141	(62.4)		
Seldom	73	13	(17.8)	73	42	(57.5)		
Other Factors								
Special food needs								
Yes	118	26	(22.0)	116	75	(63.6)	0.404	0.422
No	198	36	(18.2)	196	116	(59.2)		
Food provided by the accommodation meets participants' special needs							0.547	0.024
Yes	56	13	(23.2)	55	28	(50.9)		
No	20	6	(30.0)	20	16	(80.0)		
Transport type								
Own car	186	31	(16.7)	184	103	(56.0)	0.106	0.029
Other methods*[1]	129	31	(24.0)	129	88	(68.2)		
Purchase own food								
Yes(All/Some)	288	57	(19.8)	286	178	(62.2)	0.945	0.061
No /Little	26	5	(19.2)	26	11	(42.3)		
Difficulties to get to and from the shops								
Some difficulties (Very difficult / A little difficult)	98	30	(30.6)	98	76	(77.6)	0.001	<0.0001
No difficulties	215	32	(14.9)	213	113	(53.1)		

*[1] Bus, walk, train, bicycle, friends' car, relatives' car, taxi

4.3.2 Food insecurity status using the multi item measure

In relation to food insecurity using the multi item measure, three in five students (60.8%, n = 198) reported having at least one indicator of food insecurity. This included anxiety over food shortage, reduced diet quality, or variety and appeal; and also included the questions that indicated the severe form of food insecurity. The probability of food insecurity was significantly higher among international students (69.9 % vs 51.6% domestic, p = 0.001); for students for whom English was not their first language (69.9% vs 53.1% English as a first language, p = 0.003); among those who had been studying at UOW for less than two years when compared with studying for more than two years (71.6% vs 52%, p < 0.0001); studying coursework (under or post-graduate) (70.7% vs 49.7 post-graduate research, p = <0.0001); younger (65 % vs 49.3% 35 years and older, p = 0.016); not living with partner or parents (68% vs 52.3%, p = 0.005); no employment (68.6 % vs 49% had employment, p = 0.001); and not having a scholarship (67.6 % vs 55% had a scholarship, p = 0.021).

The average age for food-insecure students was 29 years (SD 8.09). Among the students who had more than two children, 68.8% reported experiencing food insecurity, though the number of students with children participating in the questionnaire was low (n=16). The proportion of food insecurity among unrelated adults living together was 71.3%. Living in the Illawarra was a significant predictor of food insecurity (P = 0.031) when compared with students who lived in Sydney. Affiliation to faculties had a significant effect in terms of food insecurity: p = 0.025 when food insecure students from the different faculties compared together. Education students were the most food-secure in UOW in particular when compared

with students in other faculties. It should however be noted, there was only a relatively small number of education student respondents (n=21) so this may not be representative of all education students. Area of origin had a significant difference in terms of food security ($p = 0.005$). North American students reported being the most food-secure and students from South America were the most food insecure but the numbers in each cell were too small to conclude meaningful statistical analysis. However, the rates of food insecurity of Australian students compared with Middle Eastern and Asian students were significantly different, 51.6% Australian vs 73.6% Middle Eastern $p = 0.005$ and 51.6% Australian vs 71.6% Asian, $p = 0.004$ (Table 4.5).

Measures of economic status were related to food insecurity, since employment, income level, scholarship status and renting were significantly associated with food insecurity. A significant difference was found for students who were in rental accommodation compared with students who owned their own home, were buying a home or who lived at home with their parents (69.3 % in rent vs 37.3%, $p < 0.0001$). Income overall, and at each level, compared with the level above, was associated with food insecurity ($p <0.0001$) (Table 4.6). Students' working hours were also significantly associated with food insecurity. Students who worked less than 20 hours a week were more likely to be food insecure, though this was not statistically significant ($p = 0.054$).

Food access and availability factors were associated with food insecurity (Table 4.7). Transport was associated with food insecurity, with a difference between students who used their own car for shopping versus students who used other transportation methods (56% vs 68.2% food insecure, $p = 0.029$). Those students who suffered

difficulties getting to shops to buy food reported a significantly different rate of food insecurity when compared with students who did not suffer any difficulties (77.6% vs 53.1%, $p < 0.0001$). Students who were in accommodation that provided food that did not meet their special needs were more likely to report food insecurity, $p = 0.024$ (Table 4.7). Other reasons for not obtaining the quality or variety of food desired was also found to significantly affect students' food security including: location of food stores, price of food, quality of food and variety of food as shown in Table 4.7. On the other hand, gender; area of origin; need for special food; number of people living in a household; number of children; availability of healthy food and enough time for shopping or cooking did not differ significantly between the food-secure and food insecure students.

In summary, using the multi item *Chi square* test analysis, the following variables were found to be significantly associated with food insecurity: student's age; nationality; first language; living arrangement; length of time as a student in Wollongong; type of study; area of residence (Illawarra/Sydney); household arrangement; scholarship and monthly income; employment status; location of food stores; price of food; availability of culturally appropriate foods; quality of food; variety of food; living in accommodation that provided food that did not meet students special food needs; transport type and difficulty to travel to food shops.

4.3.2.1 Predictors of food insecurity using Multivariate Logistic regression

Univariate analysis of food insecurity (calculated at 95% confidence interval) (Table 4.8) demonstrated that international students and students studying coursework were more than two times more likely to be food insecure, compared to domestic students

and students studying a research degree. Among the food access variables, students who reported price of food as a reason for not obtaining good food were 4.5 more likely to be food insecure compared to those students who did not report price of food as a problem. Students who did not have a scholarship were 1.5 times more likely to be food insecure compared to those with a scholarship; students who had no employment were 2.2 times more likely to be food insecure compared to those with employment; and students with a monthly income less than $5000 were more than ten times more likely to be food insecure compared to those students with a higher monthly income. Students who lived in rental accommodation were 3.8 times more likely to be food insecure than students in non-rental accommodation.

All the statistically significant variables in Chi square test from Tables 4.5, 4.6 and 4.7 were separately included and analysed in the multivariate logistic regression as groups: student type, economic and food access factors. Nationality and type of study remained significant in model 1 in terms of demographic characteristics when they were adjusted for each other in the model. Among the food access variables (model 2), students who reported price of food as a reason for not obtaining good food were six times more likely to be food insecure, after adjusting for a range of food access variables. In addition, all of the economic variables remained significant in model 3. The significant variables that remained in the models 1, 2, 3 are shown in Table 4.8. Both the standard errors for the β coefficients in logistic regression test and relative risk odds ratio in crosstab test have been investigated and they were identified that no significant collinearity occurred among the independent variables

Table 4.8 Multivariate Logistic regression three models assessing factors associated with food insecurity (student type, food access and availability and economic factors), Odds Ratio (OR and 95% Confidence Interval (CI)

Groups variables	Risk factor	Univariate OR (95% CI)	Multivariate OR, (95% CI)
Model 1. Student type	***Nationality*** Domestic International	1.0 2.2	1.0 2.42 (1.5, 4.0)
	Type of study Research Coursework	1.0 2.4	1.0 2.65 (1.62, 4.33)
Model 2. Food access and availability	***Price of food, reported as a reason for not obtaining quality or variety*** Seldom Always / occasionally	1.0 4.5	1.0 6.23 (1.47, 26.46)
Model 3 Economic	***Scholarship*** Yes No	1.0 1.5	1.0 3.14 (1.75, 5.62)
	Employment status Yes No	1.0 2.2	1.0 1.93 (1.1, 3.44)
	Monthly income >$ 5000 <$5000	1.0 10.3	1.0 6.44 (1.76, 23.53)
	Household arrangements Own home, buying home or living at home with parents or relatives Renting	1.0 3.8	1.0 3.2 (1.72, 5.92)

Variables included in model 1: Age groups, nationality, first language, period of study, type of study, and household structure.

Variables included in model 2: Special food needs, transport type, difficulties getting to the shops, location of food stores, availability of culturally appropriate foods, price of food, quality of food, variety of food

Variables included in model 3: Scholarship, household arrangements, employment status, monthly income.

Only variables which remained statistically significant in the model 1, 2 and 3 were included in the final model (see Table 4.9). In the final model people who reported that the price of food affected their ability to obtain good food were 13 times more likely to report food insecurity, after adjusting for other confounding variables (13.30 95% CI: 2.32-76.16). International students were 2.7 times more likely to report food insecurity compared to domestic students, though this was not significant in the final model, after adjusting for confounding variables. The model satisfied the Hosmer - Lemeshow goodness-of-fit test.

Table 4.9 Multivariate Logistic regression final model predicting factors associated with food insecurity

Groups variables	**Risk factor**	**Multivariate Odds ratio (OR), 95% Confidence interval (CI)**
		Final Model
Student type	***Nationality*** Domestic International	1.0 2.74 (0.863 , 8.73)
Food access and availability	***Price of food, reported as a reason for not obtaining quality or variety*** Seldom Always / occasionally	1.0 13.30 (2.32 , 76.20)

The final model included the following variables: nationality, type of study, price of food, scholarship, household arrangements, employment status, and monthly income.

4.3.3 Severe level of food insecurity using multi item measures

A severe level of food insecurity was defined in cases where people reported experiencing reduced food intake and disrupted eating patterns. About a third of students (37.7%) reported a severe level of food insecurity. Severe food insecurity had a significant association with length of study, type of study, living arrangement, age, income, scholarship, level of difficulty to get to and from the shops, and housing arrangement. However, it was not associated with gender, nationality, language, suburb, faculty, employment status, area of origin or type of transportation.

Students who had studied at UOW less than two years, coursework students and those who lived in households with no children (households with no children plus group, unrelated adults) experienced higher levels of food insecurity ($p = 0.007$, 54.6% vs 45.4%, $p < 0.0001$, 49.7% vs 24%, $p = 0.032$, 81.9% vs 18.1% respectively). There were significant differences across the faculties; however there was only a relatively small sample from some faculties, as shown in Table 4.10, so these differences should be interpreted with caution.

Table 4.10 Severe level of food insecurity status of the sample using multi item measures in relation to the demographic attributes

Factors	Total n (337)	Severe level of FI		χ^2 severe level of FI
		n	(%)	*p value*
Gender				
Male	130	52	(40.0)	0.473
Female	186	67	(36.0)	
Nationality				
Domestic	161	63	(39.1)	0.531
International	154	55	(35.7)	
First language				
English	162	62	(38.3)	0.816
No	146	54	(37.0)	
Period of study				
<2 years *[1]	142	65	(45.8)	0.023
2-<3 years	59	20	(33.9)	
3+	115	34	(29.6)	
Suburbs				
Illawarra suburbs	286	111	(38.8)	0.285
Sydney suburbs	25	7	(28.0)	
Faculties				
Arts, Creative Arts, Law.	28	15	(53.6)	0.171
Sydney Business School, Commerce.	37	14	(37.8)	
Engineering, Informatics.	83	29	(34.9)	
Health Sciences, Medicine.	144	55	(38.2)	
Education	21	4	(19.0)	
Type of study				
Under/ Post-graduate coursework	165	82	(49.7)	<0.0001
Post-graduate research	150	36	(24.0)	
Age groups				
18 – 24	100	47	(47.0)	0.006
25 – 34	135	52	(38.5)	
35 +	7	18	(23.7)	
Living arrangement				
Household with no children	126	45	(35.7)	0.028
Household with dependent children	78	21	(26.9)	
Group, unrelated adults (house/flat mates)*[2]	109	50	(45.9)	
Number of people				
0-1	30	11	(36.7)	0.925
2-5	277	104	(37.5)	
6+	307	115	(37.5)	
Number of Children *among people who have children*				
1-2	62	20	(32.3)	0.575
>2	16	4	(25.0)	
Areas of origin				
Australia	161	63	(39.1)	0.690
Middle East	53	20	(37.7)	
Asia	74	27	(36.5)	
Europe	12	4	(33.3)	
North America	10	2	(20.0)	
South America	3	2	(66.7)	

*[1] p = 0.007 cf. to > 2 years. *[2] p = 0.008 cf. to household with dependent children.

Students earning less than $1000 monthly income had a higher proportion of severe food insecurity when compared with students earning $1000 – $4999 per month (p = 0.001) and those students earning $5000 - $9000 + monthly (p <0.0001) (see Table 4.11).

Table 4.11 Severe level of food insecurity of the sample using multi item measures in relation to economic factors

Factors	**Total n (337)**	**Severe level of FI**		**χ^2 severe level of FI *p value***
		n	**(%)**	
Employment status				
Yes	129	45	(34.9)	0.431
No	186	73	(39.2)	
Income/month				
< $1000*[1]	93	50	(53.8)	
$1000- $4999*[2]	169	54	(32.0)	<0.0001
$5000- $9000+	22	1	(4.5)	
Scholarship				
Yes	168	48	(28.6)	<0.0001
No	147	71	(48.3)	
Housing arrangements				
Renting	232	99	(42.7)	0.002
Others	84	20	(23.8)	

*[1] p < 0.005 cf. to $1000 – $4999 and $5000 – $9000 +. *[2] p < 0.005 cf. to $5000 – $9000+.

In terms of the reasons for not obtaining quality or variety of food desired, there was no difference in students' severe food security status regarding the availability of healthy food and availability of culturally appropriate foods (see Table 4.12).

Table 4.12 Severe level of food insecurity of the sample using multi item measures in relation to food access and availability

Food access and availability factors	Severe level of FI			χ^2 severe level of FI *p value*
	Total (337)	**n**	**(%)**	
Reasons given for not obtaining quality or variety of food				
Location of food stores				
Always/ Occasionally	179	78	(43.6)	0.042
Seldom	125	40	(32.0)	
Price of food				
Always/ Occasionally	168	70	(41.7)	<0.0001
Seldom	131	47	(35.9)	
Availability of healthy food				
Always/ Occasionally	147	57	(38.8)	0.309
Seldom	151	57	(37.7)	
Availability of culturally appropriate foods				
Always/ Occasionally	252	110	(43.7)	0.855
Seldom	56	8	(14.3)	
Quality of food				
Always/ Occasionally	220	94	(42.7)	0.014
Seldom	78	21	(26.9)	
Variety of food				
Always/ Occasionally	206	93	(45.1)	<0.0001
Seldom	89	21	(23.6)	
Other factors				
Special food needs				0.917
Yes	118	44	(37.3)	
No	198	75	(37.9)	
Food provided by the accommodation meets participants' special needs	56	17	(30.4)	0.050
Yes	20	11	(55.0)	
No				
Transport type				
Own car	186	67	(36.0)	0.440
Other methods*[1]	129	52	(40.3)	
Purchase own food				
Yes(All/Some)	288	110	(38.2)	0.255
No /Little	26	7	(26.9)	
Difficulties to get to and from the shops				
Some difficulties (Very difficult / A little difficult)	98	57	(58.2)	<0.0001
No difficulties	215	61	(28.4)	

*[1] Bus, walk, train, bicycle, friends' car, relatives' car, taxi

4.3.4 Food insecurity among students with children in the households (Multi item)

Food insecurity was also reported in households that included children, although the numbers of respondents were small. Among 87 students' households which included children there were three households who reported that children skipped meals. Seven households were unable to give their children enough to eat and that was reported to occur in five households for more than three months of the year. There were two households which reported their children did not eat for a whole day (see Table 4.13). The numbers in each cell were too small to conduct meaningful statistical analysis in relation to the students' households. The data are available in table 4.13 and Appendixes H, I and J.

Children of fathers who were students experienced food insecurity five times more than children who had mothers who were students. International students reported their children as food insecure more than domestic students with children, and children with parents who spoke a language other than English as their first language were two times more food insecure than children of students who had English as their first language. Parents from the Middle East reported the highest rate of food insecurity for their children (n = 6, 19.4%). Demographic attributes of student households with children experiencing food insecurity as measured using the multi item measures are described in Appendix H.

Table 4.13 Food insecurity among children of participants (Multi item)

Question	Total 87/337	Missing	Affirmative Responses		Negative Responses	
			n	(%)	n	(%)
In the last 12 months, did (your child /any of your children) ever skip meals because there wasn't enough money for food?	78	259	3	(3.8)	75	(96.2)
My (child was/ children were) not eating enough because I just couldn't afford enough food	77	260	7	(9.1)	70	(90.9)
In the last 12 months did (your child/any of the children) ever not eat for a whole day because there wasn't enough money for food?	75	262	2	(2.7)	73	(97.3)

In terms of economic characteristics, parent students with no employment, with a monthly income less than $5000 or living on a scholarship were more likely to have children suffering food insecurity (data included in Appendix I).

Despite the numbers being small, the factors that affected children's food security among the students' households are useful to note. These factors included: parent students who were concerned about the locations of food stores, the price of healthy food, availability of culturally appropriate food, and quality and variety of food; parent students with special food needs; food provided in accommodation did not meet the family's special food needs; parent students did not own a car; parent students responsible for buying food in the household; and students who found difficulties getting to the shops. Appendix J tabulates food access and availability questions in students' households with children that were food insecure using multi item measures.

4.3.5 Food insecurity by each item

Despite students in the study sample living in an affluent university and community, a relatively high proportion of students reported food insecurity (Table 4.14). One in five students reported that they ran out of food and could not afford to buy more, about one in two experienced stress about food they wanted for social occasions and a third of the students worried whether their food would run out before they got money to buy more. One quarter of the students' food did not last and they did not have money to get more. A balanced meal was not affordable for more than 40% of the students. Over a quarter of students (27.9%) cut the size of their meals or skipped meals because there was not enough money for food, and this happened for half of them in three or more months during the year. One in four students ate less than they felt they should and one in five were hungry but did not eat because food was not affordable. There were a large number of students who did not eat for a whole day (25 students) and that happened to half of them in three or more months during the year. One in ten students reported that they lost weight because they did not have enough money for food. These data indicate that food security was reported as a significant issue for many UOW students.

Table 4.14 Students' responses to each food security questions

Question	Total	Missing	Affirmative responses		Negative responses	
			N	(%)	n	(%)
In the last 12 months, or since you started studying at the university if this is less than 12 months, were there any times that you ran out of food and could not afford to buy more?	316	21	62	(19.6)	254	(80.4)
When this happened did you go without food?	82	255	45	(54.9)	37	(45.1)
I feel stressed because I can't provide the food I want for social occasions	310	27	134	(43.2)	176	(56.8)
I worry whether my food will run out before I get money to buy more.	311	26	103	(33.1)	208	(66.9)
The food that I bought just didn't last, and I didn't have money to get more.	309	28	78	(25.2)	231	(74.8)
I couldn't afford to eat balanced meals.	308	29	128	(41.6)	180	(58.4)
Did you ever cut the size of your meals or skip meals because there wasn't enough money for food?	315	22	88	(27.9)	227	(72.1)
Did you ever eat less than you felt you should because there wasn't enough money to buy food?	315	22	82	(26.0)	233	(74.0)
Were you ever hungry but didn't eat because you couldn't afford enough food?	313	24	57	(18.2)	256	(81.8)
Did you ever not eat for a whole day because there wasn't enough money for food?	316	21	25	(7.9)	291	(92.1)
Did you lose weight because you did not have enough money for food?	310	27	30	(9.7)	280	(90.3)

[A B C] Indicate questions' classification [A] items from the Australian National Health Survey which is used to calculate the prevalence of food security in Australia, [B] multi item measures (FSSM) from USDA, [C] multi item indicate severe food insecurity.

4.3.6 Comparison of the food security measurement tools

The proportion of food insecurity among UOW students surveyed using the single item measure was 19.6% (n = 62). However, food insecurity using the more sensitive multi item measure has identified three in five students (60.8%, n = 198) experienced some level of food insecurity and 37.7% of the participant students reported a severe level of food insecurity. Table 4.15 summarises the levels of food insecurity using the single and multi item measures. Thus much higher levels of food insecurity were identified by the multi item measure.

Table 4.15 Food insecurity using the single and multi item measures among participants

Type of food security measure	Total	Missing	Food insecurity	
			n	(%)
Food insecurity status (Single item)	316	21	62	(19.6)
Food insecurity status (Multi item)	314	23	191	(60.8)
Severe level of food insecurity status (Multi item)	316	21	119	(37.7)

4. 4 Food access, purchasing behaviours and special food needs

Table 4.16 tabulates the food habits and purchasing behaviours of the study population. Meals (breakfast, lunch and dinner) of 17.5% of the students were provided by students' accommodation. Two thirds (65.5%) of the students had no special food needs. Among the third with special food needs, about one fifth required *halal* food (21.4%), almost 10% of those with special food needs were vegetarian and 6% reported having food allergies. Figure 4.2 shows the distribution of students

who reported special food needs. Reported food allergies/ sensitivities included: hazelnuts, spices, fish, shellfish, poultry, dairy, yeast, soy, cucumber, garlic, watermelon, rockmelon, honeydew, Brussel sprouts, spinach, cabbage, cauliflower, and fructose. Additionally, special diets related to diseases included: Coeliac disease, Diabetes, Maple syrup urine disease, Crohn's disease.

When students were asked about whether the accommodation met their special food needs, a large proportion indicated that this question was not applicable (68.8%), which is likely to indicate they either do not have special foods needs or do not have supported accommodation which provides food. However, it is acknowledged there could be some limitations with interpreting data from this question, given that the questionnaire tool did not differentiate between these two factors. Of the 80 people who did answer this question as either 'yes' or 'no', 59/80 (73.8%) indicated the accommodation did meet their special food requirements. Care needs to be taken when using data from this question because of this limitation, and for that reason this question has not been included in any of the multivariate analyses in relation to food security.

More than 50%of students used their own car as a method of transportation to the shops. Fewer students who had their own car reported difficulties getting to the shops compared with students who used other methods of transportation (29.4% vs 70.6%, $p < 0.0001$).

Table 4.16 Food habits and purchasing behaviours of the participants

Factors	Total (n) 337	(%)
Special food needs		
Yes	121	(36.2)
No	213	(63.8)
Food provided by the accommodation meets participants' special needs		
Yes	59	(18.9)
No	21	(6.7)
N/A	232	(74.4)
Transport type *(More than one response allowed)*		
Own car	194	(57.6)
Walk	133	(39.5)
Bus	129	(38.3)
Friends' car	51	(15.1)
Other*	93	(19.0)
Purchase own food		
Yes(All / Some)	303	(91.5)
No/ Little	28	(8.5)
Difficulties to get to and from the shops		
Some difficulties (Very difficult / A little difficult)	102	(31.0)
No difficulties	227	(69.0)

*Relatives' car, taxi, train or bicycle

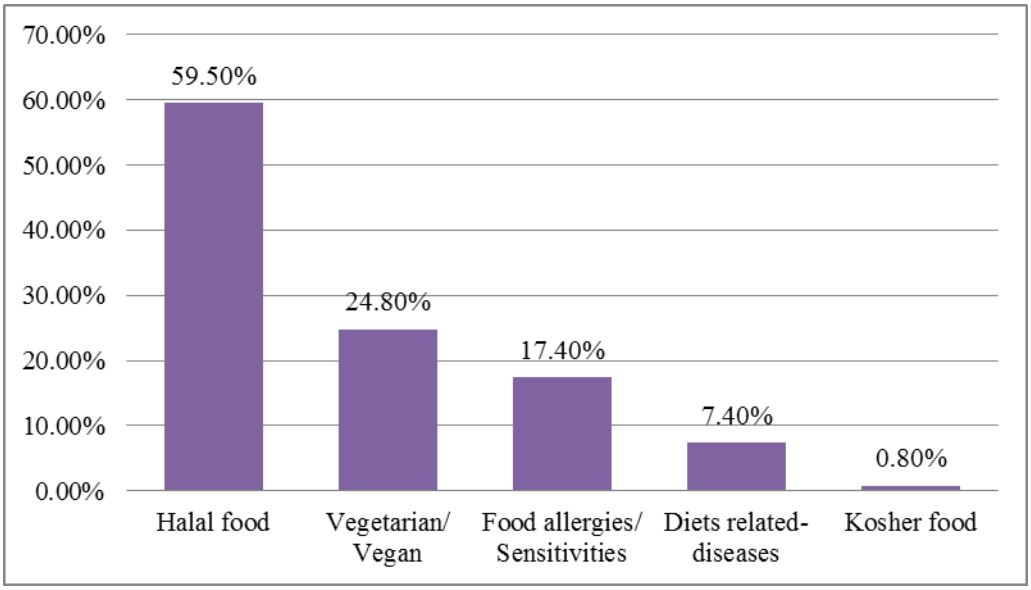

Figure 4.2: Students with special food needs

(n=121)

The majority of the students reported that they could not obtain good food because of the quality of food, variety of food and not enough time for shopping, (see figure 4.3). Both domestic and international students reported that the reasons for not obtaining the quality or variety of food desired was the high price ($p = 0.214$) of food and the limited time for shopping or cooking ($p = 0.650$). International students in contrast to domestic students were more concerned ($p < 0.0001$) about location of food stores and the availability of culturally appropriate foods. Special food needs were more likely to be reported by international students (45.5% vs 27% domestic, $p = <0.0001$). The majority of domestic students used their own cars for shopping (77% vs 40% international, $p = <0.0001$) and they considered the shopping was not difficult, compared with international students (80% vs 57.5%, $p = <0.0001$) (see Table 4.17).

Table 4.17 Food access and availability factors among domestic and international students

Food access and availability factors	Total n= 337	(%)	Domestic		International		χ^2 test *P value*
			n	(%)	n	(%)	
Reasons given for not obtaining quality or variety of food desired included							
Location of food stores							
Always/ Occasionally	187	(58.8)	66	(40.5)	121	(78.1)	<0.0001
Seldom	131	(41.2)	97	(59.5)	34	(21.9)	
Price of food							
Always/ Occasionally	264	(82.0)	131	(79.4)	133	(84.7)	0.214
Seldom	58	(18.0)	34	(20.6)	24	(15.3)	
Availability of healthy food							
Always/ Occasionally	176	(56.4)	79	(48.5)	97	(65.1)	0.003
Seldom	136	(43.6)	84	(51.5)	52	(34.9)	
Availability of culturally appropriate foods							<0.0001
Always/ Occasionally	152	(49.0)	36	(22.9)	116	(75.8)	
Seldom	158	(51.0)	121	(77.1)	37	(24.2)	
Quality of food							
Always/ Occasionally	229	(73.6)	109	(68.1)	120	(79.5)	0.023
Seldom	82	(26.4)	51	(31.9)	31	(20.5)	
Variety of food							
Always/ Occasionally	216	(70.1)	99	(62.3)	117	(78.5)	0.002
Seldom	92	(29.9)	60	(37.7)	32	(21.5)	
Not enough time for shopping or cooking							0.650
Always/ Occasionally	237	(75.5)	124	(76.5)	113	(74.3)	
Seldom	77	(24.5)	38	(23.5)	39	(25.7)	
Other factors							
Special food need							
Yes	120	(36.1)	45	(26.9)	75	(45.5)	<0.0001
No	212	(63.9)	122	(73.1)	90	(54.4)	
Food provided by the accommodation meets participants' special needs							0.042
Yes	59	(73.8)	26	(86.7)	33	(66.0)	
No	21	(26.3)	4	(13.3)	17	(34.0)	
Transportation							
Own car	193	(58.7)	128	(76.6)	65	(40.1)	<0.0001
Other methods	136	(41.3)	39	(23.4)	97	(59.9)	
Purchase own food							
Yes (All/Some)	301	(91.5)	152	(91.6)	149	(91.4)	0.960
No /Little	28	(8.5)	14	(8.4)	14	(8.6)	
Difficulties to get to and from the shops							
Some difficulties (Very difficult / A little difficult)	101	(30.9)	33	(19.8)	68	(42.5)	<0.0001
No difficulties	226	(69.1)	134	(80.2)	92	(57.5)	

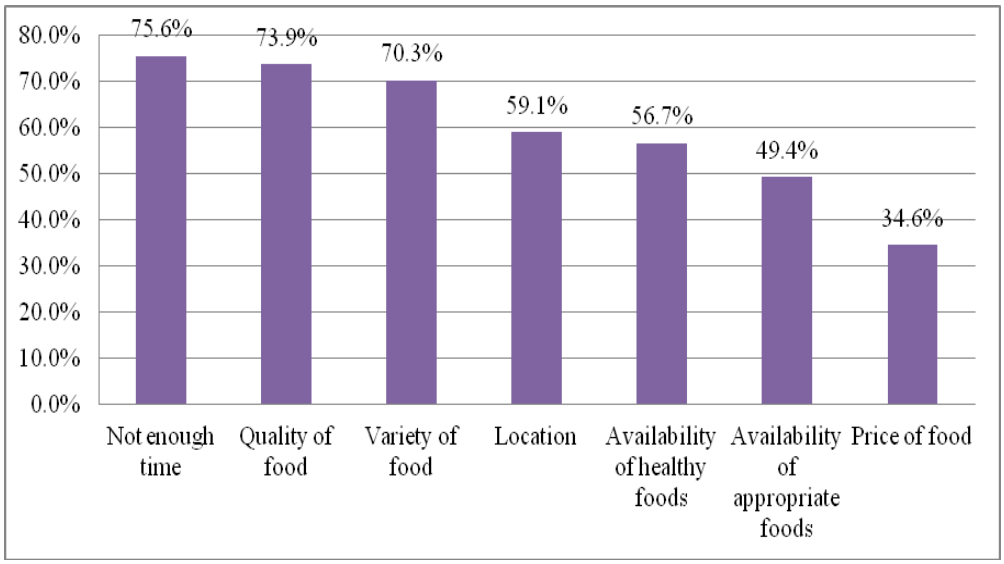

Figure 4.3 Reported reasons for not obtaining quality or variety of food desired among students

(Multiple responses allowed**)**

In terms of food buying habits, about 40% of the participants bought their meat requirements from supermarkets and approximately one quarter bought meat from *halal* butchers. Those students who bought their meat from *halal* butchers experienced more difficulties accessing these, compared with students who bought from other butchers ($p = 0.001$) or from both supermarkets and butchers ($p = 0.020$). Two in five students bought their households' fruit and vegetables from fruit and vegetable markets, as shown in Table 4.18. There was no significant difference in food security levels associated with the different places where students bought their food.

Table 4.18 Distribution of the sample according to places where food is purchased; difficulty to get to and from the shops to buy food

Students' shopping places	**Total n= 337**	**(%)**	**With some difficulties**		**With no difficulties**		**χ^2 test *P value***
			n	**(%)**	**n**	**(%)**	
Meat							
- Supermarkets only	115	(41.7)	36	(31.6)	78	(68.4)	
- Supermarkets and butchers	50	(18.1)	10	(20.0)	40	(80.0)	
- Halal butchers only	71	(25.7)	28	(40.0)	42	(60.0)	0.004
- Other butchers only	40	(14.5)	4	(10.0)	36	(90.0)	
- Missing and not applicable (61)							
Fruit and vegetables							
- Supermarket only	109	(34)	35	(32.7)	72	(67.3)	
- Fruit and vegetable markets only	125	(38.9)	34	(27.4)	90	(72.6)	0.574
- Supermarket and Fruit and vegetable markets	87	(27.1)	29	(33.3)	58	(66.7)	
- Missing (16)							
Groceries							
- Supermarkets only	246	(77.6)	67	(27.3)	178	(72.7)	
- Supermarkets and local food stores	46	(14.5)	22	(47.8)	24	(52.2)	0.018
- Local food stores only	25	(7.9)	9	(37.5)	15	(62.5)	
- Missing (20)							

Supermarkets were reported to be the main food shopping venue for buying grocery requirements for the majority of domestic and international students. Students who purchased their foods from both the supermarkets and local food stores reported significantly more difficulty compared with students who bought their groceries only from supermarkets (p = 0.006). Among the student participants who reported having special food needs, local food stores followed by supermarkets were the food purchase locations most frequently reported by the students, as shown in figure 4.4.

Figure 4.4 Locations where students buy their special food among students with special food needs

The level of shopping difficulties and shopping locations reported by domestic and international students was significantly different. The majority of domestic students purchased their meat requirements from supermarkets or butchers (90.6%) while 41% of international students purchased their meat requirements from *halal* butchers. International students experienced greater difficulty travelling to and from the shops to buy food ($p = < 0.0001$). The majority of domestic students reported using their own cars for food shopping while 71.3% of the international students depended on friends' cars, relatives' cars, buses, walking, trains, bicycles and taxis.

As shown in figure 4.5 the main barrier faced by students to acquire their food was adequate time to shop and cook food. The *Chi square* test analysis of questions assessing the relationship between barriers faced by students to acquire their food and food insecurity (categorised by the multi item measures) indicates that there were significant differences observed for associations between distance to food shops

(n = 79, 72.5% vs n = 30, 27.5%, p = 0.048), food storage capacity and cooking equipment (n = 59, 76.6% vs n = 18, 23.4%, p = 0.017), space to prepare food and cooking facilities at home (n = 41, 82% vs 9, 18%, p = 0.007) and mobility to shop and cook food (n = 42, 80% vs n = 10, 19.2%, p = 0.011). There was no significant difference found for associations between the other factors and food insecurity. Table 4.19 presents the data on barriers to food access and availability among students who were food insecure. These barriers to obtaining food could be considered to be quite different to the financial factors included in the single item food security measure.

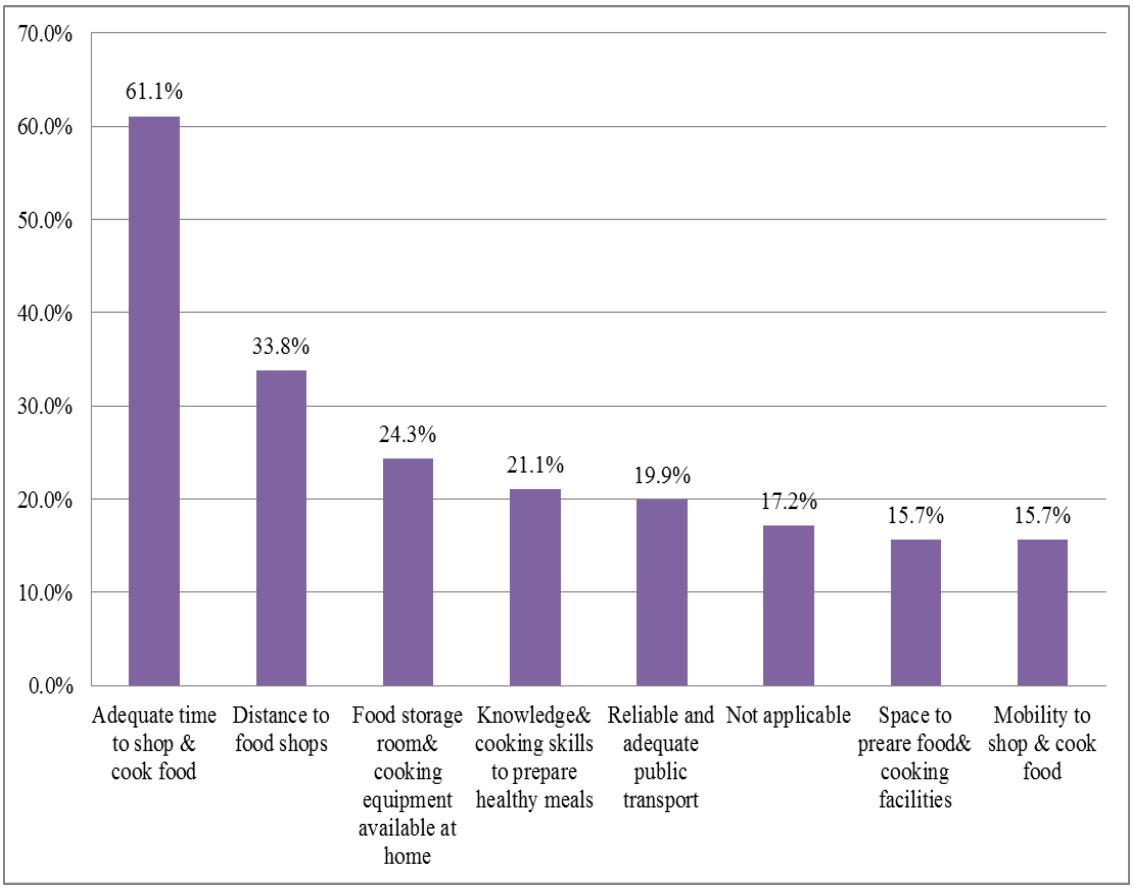

Figure 4.5: Reported students' barriers to obtain preferred food

Table 4.19 Relation of food insecurity with students' barriers according to their food needs

Students' barriers according to their food needs	Food insecurity measure					
	n	Single item%	n	FI, Multi item%	n	Severe level of FI/ Multi item%
Distance to food shops	24	(22.0)	79	(72.5)	51	(46.8)
Reliable and adequate public transport	17	(26.6)	44	(68.8)	33	(51.6)
Knowledge and cooking skills to prepare healthy meals	14	(20.6)	48	(70.6)	33	(48.5)
Food storage room and cooking equipment available at home	21	(26.9)	59	(76.6)	39	(50.0)
Space to prepare food and cooking facilities (e.g. stove, oven, microwave) at home	15	(30.0)	41	(82.0)	28	(56.0)
Adequate time to shop, prepare and cook food	41	(21.0)	126	(64.9)	80	(41.0)
Mobility to shop and cook food	20	(38.5)	42	(80.8)	30	(57.7)

The prevalence of food insecurity among students who have special food needs using the single and multi item measures is presented in Table 4.20. It can be observed that 69% and 67.1% respectively of vegetarian students and students who required *halal* food suffered food insecurity and about half of the vegetarian students suffered a severe level of food insecurity, as measured by multi item tool. Results obtained using the single item measure indicated that students with food allergies or sensitivities had 9.5% food insecurity. Food insecurity for those same students measured by the multi item measures revealed that 47.6% were food insecure and 33.3% experienced a severe level of food insecurity.

Table 4.20 Food insecurity among students who have special food needs

Special food	Total n=121	Food insecurity measure					
		n	Single item%	n	Multi item /FI %	n	Multi item /severe FI%
Halal food	70	15	(21.4)	47	(67.1)	25	(35.7)
Kosher food	1	0	(0.0)	0	(0.0)	0	(0.0)
Vegetarian/Vegan	29	10	(34.5)	20	(69.0)	13	(44.8)
Food allergies/ Sensitivities	21	2	(9.5)	10	(47.6)	7	(33.3)

4. 5 Students' opinions regarding food access and availability

The student sample was asked what they would suggest should occur to make it easier for university students to access the amounts and type of foods required to meet their needs. A total of 197 students made suggestions that may assist university students. Students were able to give more than one suggestion. These key suggestions included the following main points: the food cost, unhealthy food, access to shops and unavailability of special food. Key students' suggestions regarding facilitating food access are provided in Appendix K.

5 DISCUSSION

This chapter discusses the main findings of the study. The key finding of this research was the high reported prevalence of food insecurity amongst the students. Food insecurity was clearly identified as “the skeleton in the university closet”, as previously acknowledged by Hughes and et al (2011, p 27). Particular student groups were at very high risk, in particular international students, younger students, those in the first few years of their studies and those renting and on low incomes.

The present study used both a single item measure of food insecurity used previously in the Australian National Nutrition Survey and multi item measures of food insecurity developed in the U.S. and used in international and Australian studies. The U.S. official coding guidelines were not followed given that changes had been made to the questionnaire. The subsequent analysis allowed for comparisons with other Australian studies of food insecurity among tertiary students and the general population. It is acknowledged that the different coding may have affected the comparability with U. S. studies.

The study also investigated food access, purchasing behaviours, shopping barriers and special food needs factors found to significantly affect students’ risk of food insecurity including transport, social and cultural factors.

5. 1 Food security status

This study found that the level of food insecurity is high among this university student community compared with other studies in adult and university populations. Both the single and multi item measures revealed significant levels of food insecurity

5.1.1 A comparison with the general Australian population

This study found that students at the University of Wollongong (UOW) experienced higher levels of food insecurity than have been reported for the general adult Australian population using the single item question. The single item measure reports food insecurity in terms of economic access to food. The level of food insecurity at UOW (20%) was about four times more than that observed in the last national survey of food insecurity in Australia in 2005 (5%) and in the New South Wales Health Survey through the years 2002 to 2009 (range 4.4% to 6.1%) (Rychetnik et al. 2003; NSW Health 2009), and approximately three times the level (7%) reported in a study among the South Australian population using the single item tool (Foley et al. 2009).

The findings of the current study are consistent with those of Chaparro et al (2009) and Hughes et al (2011). Chaparro et al found the level of food insecurity among Hawaiian university students was approximately three times higher than that stated for the state of Hawai'i by the US Department of Agriculture (USDA) for the years 2004–2006 and higher than the rates found for Hawaiian residents by the Hawai'i Health Survey (HHS) of 1999–2000 (Chaparro et al. 2009). Correspondingly, the level of food insecurity reported within the Queensland university students was more than double of that found at NNS among the general Australian adult population (Hughes et al. 2011). It can be concluded from the current study and the two

published university studies (Chaparro et al. 2009; Hughes et al. 2011) that university students are more likely to be food insecure than the general population.

5.1.2 A comparison with other university populations

The level of food insecurity found in this study was consistent with those found in other studies among university populations in Australia and the USA. The levels of food insecurity were higher than those found in Mānoa, Hawai'i (Chaparro et al. 2009), and similar to those reported in a previous Australian study (Hughes et al. 2011). However, it should be kept in mind that the coding procedures varied across these studies and this may impact on the comparability of the results.

Using this single item measure the results from the current study were approximately 1.5 times higher than those of a study conducted in Queensland among university students using the same tool (13%) (Hughes et al. 2011).

The high level of food insecurity found in this study compared to the Australian Queensland university students using the single item measure (Hughes et al. 2011) may be linked to particular demographic and economic characteristics. These may include differences in the distribution of international students in this study, where 50% of respondents were international students, compared with the Queensland university study, which had 30% international students and the NNS study which did not include international adults. Furthermore, employment was shown to be different across the students in the Queensland study (70% employment and 33% receiving government benefits), compared with only 59% of domestic and international students employed in this study. One of the strong variables found through

multivariate analysis in this study was employment status; students who were employed reported two times more frequently that they were food secure than those who were unemployed. However, factors that impact on the access and availability of food may extend beyond the financial status of students at the UOW and include issues such as access and availability of culturally appropriate food for the 50% international students in this study.

Importantly, the results from the more detailed multi item measures demonstrated that three in five students experienced some level of food insecurity, and more than one third of all students experienced severe forms of food insecurity. This level of food insecurity was significantly higher than the student community in Mānoa, Hawai'i (Chaparro et al. 2009) and similar to that found among college students in Oregon (Patton-López et al. 2014). However, it was less than what has been found in the Queensland student community (Hughes et al. 2011). For example, compared with Hawai'i students at 21%, the Oregon study reported a food insecurity level of 59% and the Queensland study showed 71.8% of students were food insecure (46.5% without hunger, 25.3% with hunger), using the same tool. This study's results of food insecurity were also markedly high at 61%. The findings of this study are in agreement with previous studies despite using different codding.

The higher level of food insecurity among Queensland students using the multi item measure might reflect differences in age profiles of the participants in the studies, where 80% of the Queensland study sample were aged less than 25 years while only 31% of UOW students were in this younger age group and the majority were older and hence may have been more established (economically and personally).

Many demographic variables were found to be associated with food insecurity in the present study, especially being an international student. Significant differences were observed between domestic and international students using the multi item measures in the univariate and the multivariate analysis. This finding was the opposite of that found in the previous study of university students using the same tool (Chaparro et al. 2009). In Hawai'i multivariate analysis found that being Hawaiian or Pacific Islander was the most significant predictor of food insecurity compared with students with other nationalities (Chaparro et al. 2009). In Queensland the percentage of food insecurity among international students was higher than domestic students using the multi item measures (76.5 vs 70.1%) (Hughes et al. 2011). Just using the single item measure indicated that nationality was not a significant risk factor for food insecurity in the present study or in the Queensland study (Hughes et al. 2011).

5. 2 Economic factors associated with food insecurity among UOW students

Economic status has been found to be especially important in broader population studies in relation to food security (King et al. 2012); this was also found in this study. For both domestic and international students the second strongest predictor for food insecurity that students reported as a major reason for not obtaining the desired quality or variety of food was the cost of food, particularly among students with an income less than $1000 per month who were not living with parents or partner. Furthermore, all the economic factors in this study were shown as strong predictors when included together in the multivariate analysis for reporting food insecurity for those students. It should be noted that these economic variables are likely to be highly correlated.

The findings provided evidence of important associations between food insecurity and students with low income, students without a scholarship and students without employment. As demonstrated by previous studies of Queensland and Oregon, low income was correlated with an increased prevalence of students' food insecurity (Hughes et al. 2011; Patton-López et al. 2014). This finding was also supported by other studies (Meldrum et al. 2006; Rondeau 2007; Forbes-Mewett et al. 2009). However, the Hawaiian study could not establish an association between income variation in students' income and food insecurity. The researchers reported they had developed a spending patterns survey instrument to help answer the contribution of spending priorities. However, the instrument was found to be an imperfect measure of purchasing power and did not determine the use of credit and debt (Chaparro et al. 2009).

In terms of employment status, this study's findings were the opposite of those found in previous studies of university students. The study of Oregon reported that employed students were more likely to be food insecure (Patton-López et al. 2014). The students in the current study reported working a weekly average of 18 hours in order to meet their financial needs. This was also similar to the situation among Queensland students (17 hours/week) (Hughes et al. 2011). The students' economic status was an important contributor to their food insecurity status and warrants further exploration.

5. 3 Demographic factors associated with food insecurity among UOW students

This study explored a range of cultural and socio-demographic factors that may be associated with food insecurity among university students. Various contributing factors to university students' food insecurity were identified, including English as a second language, stage and type of study, living arrangements, and household arrangement.

The multi item measures found a higher level of food insecurity among international students, and it also was the strongest predictor in the multivariate analysis. Almost all the international students (158/167) in this study were originally from countries where English was the second or third language, or where English language was only introduced as a subject in schools. The great majority of domestic students reported they spoke English as their first language. The results in this study were similar to other studies (Hadley et al. 2007) where language played an important role for being food secure, and students who spoke English as a second language were more likely to be food insecure. This may play an important part in explaining the situation of food insecurity among international students.

Among students who had children, students were more likely to be food insecure, where they had more than two children and this was similar to findings in other literature (Foley et al. 2009). However, the number of participants with children was small and so these results should be interpreted with caution, and further investigation of this is needed.

This study is in agreement with the literature as the findings show that young students who have studied at UOW for less than two years were more likely to be food insecure. Youth in early years of university study have needs and experiences such as homesickness, anxiety about the new learning environment, and changing lifestyle. The presence of such personal and academic issues may contribute to food insecurity. These findings were the same for both domestic and international students. A range of these issues have been confirmed in the literature (Edwards et al. 2010).

This study found that students enrolled in coursework were more likely to be food insecure than research students. This is likely to reflect the student profiles of each type of study. For example research students tend to be older with more established income sources and in particular, they may be in receipt of a scholarship. In addition, coursework program students, who were usually younger, may be less able to organise themselves. This issue needs to be investigated further.

The present study provided evidence of an association between living arrangements and food security. The results revealed a high rate of food security among students living with their parents or partner. As with previous research (Chaparro et al. 2009; Hughes et al. 2011), those living with a group of unrelated adults (house/flat mates) were at significantly higher risk of food insecurity. Living with other people as a roommate has also been found by others to negatively affected university students' food choices and finances (Nugent 2011). Being parents of children has also been found to negatively affect university students' food choices and finances (Nugent 2011). However, the findings of the current study do not support the previous

research where the results showed that living in households with children positively affected students' food security.

5. 4 Food access, purchasing behaviours and special food needs

While the most common barriers identified by students to acquiring their food was adequate time to shop and cook, this did not correlate with food insecurity. Factors that were associated with food insecurity using the multi item measures were distance to shops, food storage room and cooking equipment, space to prepare food and cooking facilities, and mobility to shop and cook food. The Queensland university study, only using the single item measure, found no association between food insecure students and cooking and preparation skills, transport to shops, and cooking and storage facilities (Hughes et al. 2011). However other studies have found links between food insecurity and similar factors. A study in disadvantaged localities in Sydney found an association between food insecurity and transportation difficulties using the multi item measure (Nolan et al. 2006). In a qualitative Canadian study, participants who accessed the food bank had adequate knowledge, but time was a barrier to shopping and preparing nutritious and balanced meals, and this was strongly associated with students' ability to stay food secure and healthy (Nugent 2011).

This study found that a majority of both domestic and international students depended exclusively on supermarkets to buy their groceries. This may have reflected the retail mix in Australia where traditional local food outlets, including fresh produce markets, have given way to centralized large scale supermarkets (Dixon 2007). The students who did not find all their grocery requirements in

supermarkets also purchased food from local food stores. However, this appeared to provide additional difficulties in purchasing suitable food. Also, students who wished to purchase food from halal butchers (away from the supermarkets) reported more difficulties than students who bought from other butchers or supermarkets. Such additional difficulties might have been due to poor availability of transportation routes that were primarily organized to reach supermarkets, as has been illustrated in a previous study (Williams et al. 2004). The participant students provided several suggestions to make it easier to access the amounts and type of foods required, including making their special foods available on campus and at big supermarkets and improving public transport services to alternative shopping locations.

In terms of distance to food shops and transportation issues, the levels of difficulty getting to food shops reported by domestic versus international students were significantly different. The majority of domestic students purchased their meat requirements from supermarkets or butchers while about half of international students purchased their meat from *halal* butchers. International students also experienced more difficulty in getting to and from the shops to buy food.

As mentioned previously, international students were more food insecure. Food insecurity was five times more common among students who did not own a car and used other methods for food shopping. The results from this study indicated that the majority of domestic students used their own cars for food shopping while most of the international students depended on friends' cars, relatives' cars, buses, walking, train, bicycles and taxis. This finding was similar to findings among low income families residing in the Austin, Texas area (Clifton 2004) and in England (Robinson

et al. 2000). Comparable information is not available for university students in Australia and requires further study.

Some students in the study were food insecure not due to their financial status but because of inconvenient timing of public transport and shops' opening hours. This is consistent with the findings of a Canadian study (Nugent 2011).

Despite Australia being a developed country with a large food manufacturing sector with a full range of products, factors such as quality of food, variety of food and time were identified by both domestic and international students as reasons for not obtaining the desired food. This paradox may be attributed partly to the availability and quality of food on the university campus, which does not have a general food outlet or one in close proximity. Hence the students suggested that provision of a variety of food on campus would assist their access to quality and affordable food.

This study found that the majority of students who were vegetarian and students who required *halal* food experienced some level of food insecurity. About half of the vegetarian student respondents suffered severe levels of food insecurity. Results from the single item instrument indicated that less than one in every ten students with food allergies or sensitivities had food insecurity, while results from the multi item instrument revealed that about half of these students were food insecure and three in every ten suffered a severe level of food insecurity. These findings suggest that the multi item instrument may be more sensitive to identify variations in food security and the single item may be more limited in the detection of the physical, cultural and health factors that affect food security. Previous studies have not explored the

importance of special food needs in relation to food insecurity and this is an important new contribution of the present study.

5. 5 Single and multi item measures

The level of reported food insecurity varies depending on the use of single or multi items. Of particular interest is the identification of similar variables, socioeconomic and demographic factors, across the studies among adult and university populations.

The current study provided results which corroborate the findings of the previous work in Australia. Not surprisingly, the level of food insecurity using the multi item measures were up to three times higher than the results produced by the single item – this is likely because the multi item includes factors in addition to economic factors. As identified in the literature review, the studies that used the multi item measures reported higher levels of food insecurity than studies using the single item (see Tables 2.1, 2.3) (Nolan et al. 2006; Hughes et al. 2011; Ramsey et al. 2012). However, these studies focused on disadvantaged groups and university students and it is unclear if the results could be extended to the general population

The results of the current study indicate that the single and multi item were similar in terms of ability to assess the economic aspects and both of the measurement instruments produced similar results in terms of economic aspects of food insecurity. However, different results were found for measurement of factors such as availability of healthy food, time and special food needs. It is interesting to note that all the factors that were significant using the single item were also significant using the multi item.

The findings of this study in relation to the variables linked with food insecurity were similar to those of other studies of university communities (Chaparro et al. 2009; Hughes et al. 2011). The single item measure found variables such as fewer years of study, coursework students, lower income, scholarship, renting, food price and experiencing difficulties getting to the shops were associated with higher likelihood of food insecurity. Variables identified as associated with food insecurity in previous studies of Australian university students included period of study, income and housing arrangements (Hughes et al. 2011). Most of the factors identified in the prior studies primarily referred to financial aspects of food insecurity and did not include other important factors such as nationality, language, transportation and special food needs. The omission of such factors may lead to underestimation of the prevalence of food insecurity.

Factors identified using the multi item measure as contributing to food insecurity also were similar to the findings of other studies (Nolan et al. 2006; Hadley et al. 2007; Chaparro et al. 2009; Foley et al. 2009; Nugent 2011). These factors included students' nationalities; first language; length of time as a student; area of residence; faculties; type of study; living arrangement; area of origin; all economic factors and most of the food access and availability variables. Language, level of study, access and availability of food and economic factors have been linked to food insecurity in previous studies among adults (Nolan et al. 2006; Hadley et al. 2007; Foley et al. 2009); and among students where housing arrangements and nationality were observed as significantly relevant among Hawaiian students (Chaparro et al. 2009).

The present findings that gender and number of children in the household were factors not significantly linked with food insecurity are consistent with other research (Chaparro et al. 2009; Hughes et al. 2011). Using the multi item measure identified a high level of food insecurity among students who considered distance, public transport, knowledge and cooking skills, food storage places, cooking equipment, space to prepare food, cooking facilities, time and mobility as barriers to acquiring their food. These factors were not detected through the use of the single item measure in Hughes et al's study. These findings further support the idea of Russell and her colleagues who noted that using the single item and the multi item measurements were essential in assessing economic aspects of food insecurity. Further, the multi item measures have the ability to assess factors such as anxiety about acquiring food, and the quantity and quality of food available (Russell et al. 2013). Therefore, the multi item measure was able to identify associations with food insecurity beyond the single item measure's focus on financial factors.

The single item measure may be too simplistic to identify the complex relationship between food insecurity and the other factors explored by the multi item measures. The single item measure did not capture: the relationship between food insecurity and nationality; English as a first language; availability of culturally appropriate food; other demographic factors; and factors about access and availability of food. The single item measure only captured the economic factors of the respondents. The multi item measures exposed more than the access to and availability of food, and captured data regarding anxiety about food insecurity. However, other studies which used the single or multi item measures (Nolan et al. 2006; Foley et al. 2009; Hughes et al. 2011) did not capture the special food needs for adults or this group of

university students. The additional questions included in this study to explore the food needs related to the cultural diversity of this student population warrant consideration for inclusion in future studies of diverse adult populations.

5. 6 Predictors of food insecurity using Multivariate Logistic regression

The application of multivariate logistic regression on the findings from this study indicated that the strongest demographic predictors of food insecurity amongst university students were being an international or coursework student. It is likely that most of the international students at the UOW came from countries where English was not the first language, were living away from their parents or relatives and were living in rental accommodation, factors likely to impact on their food-insecurity status. Students' nationality also was found to be the strongest predictor for food insecurity in a Hawaiian study (Chaparro et al. 2009). However, it was opposite to the finding of this study, as the Hawaiian and Pacific Islander students were found to be the most vulnerable groups. Chaparro et al attributed this situation to the poverty rates among native Hawaiians who predominantly lived below the poverty line. The Oregon study using the multivariate analysis found that students who had low income, fair or poor health, who were employed, and who participated in food assistance programs had the highest levels of food insecurity (Patton-López et al. 2014).

In terms of food access and availability factors in the current study, students reported the price of food as a reason for not obtaining good food and all the other economic variables were strongly associated with the level of food insecurity using a multivariate logistic regression analysis (see table 4.8). The Queensland study did

not conduct a multivariate logistic regression analysis to show the strongest predictors for food insecurity among the Australian student community. The Hawaiian study did apply multivariate analysis to their results and identified that students living away from their parents or relatives in unfamiliar arrangements or with roommates were significantly more likely to be food insecure.

The final model developed through the application of multivariate analysis in this study identified that economic variables did not remain significant when simultaneously adjusted for other factors. This does not mean these are not important, it is just that the other variables explained some of these economic associations. It can be understood that there are factors beyond the economic issues which affect students' food security. The key variables in the final model of student groups at the UOW vulnerable to food security included being an international student and students who reported price of food as a reason for not obtaining good food. This interesting finding would not have been uncovered using either the single item question alone or just the set of questions from the US FSSM.

5. 7 Limitations

There are several limitations with this study. One limitation was that the study participants were not statistically representative of all UOW students in terms of gender and nationality. A further limitation was that respondents to the questionnaire may have been students with some interest in food insecurity (through personal experience or knowledge). Future studies should strive to achieve closer representation of the whole student body to gain a more accurate assessment of the extent of food insecurity among university students.

A further limitation was that some sub-population groups in the study included only a small number of people (for example, the number of student households with children, the number of students per faculty and the number of students from particular countries), thus limiting the interpretation of the data related to those sub-populations.

The lack of prior research among tertiary students impacted on the study questionnaire. The main components of this questionnaire had been validated in previous studies but new questions were added and other than testing the face validity of these questions, no further testing of the new questions occurred. Additionally, where questionnaire coding guidelines did exist, such as the U.S. official coding guidelines, these were not followed as changes to the questionnaire required different analysis to allow for comparisons with other Australian studies of food insecurity among tertiary students and the general population. However, the different coding applied in this study may have affected the comparability of this study's results with prior U.S. studies.

This study did not account for students' decision-making about spending priorities and this may warrant further exploration in future studies.

Finally, the study was conducted within a limited time period, at the end of the semester when students were busy preparing for their exams, and this may have limited participation among students. Future studies should consider contacting students earlier in the semester.

6 CONCLUSION

This study provided evidence that food insecurity amongst University of Wollongong students is a widespread problem experienced by up to three in five students. This finding of a high proportion of food insecure students is consistent with other Australian studies of university populations. The reasons for these high levels of food insecurity have not been fully identified and require further study. The finding of a high level of food insecurity at one university warrants exploration of the full extent of food insecurity amongst university students throughout Australia.

The proportion of food insecurity was significantly higher in a number of student sub-groups, and there also were issues of access to and affordability of food. The student sub-groups with the highest levels of food insecurity were international students; students for whom English was a second language; students who had studied fewer years at UOW; coursework students; younger students; students living with no parents or partner; and students living with unrelated adults. Identification of these sub-groups provides information to assist the development of specific strategies to better meet their needs.

Measures of economic status were found to be highly related to food insecurity. Students who had no employment, a lower income, no scholarship or who were in rental accommodation experienced significantly higher levels of food insecurity.

Factors that had a pronounced effect on food insecurity in this study were access to the appropriate food shops, affordability of food and availability of special food needs. Food insecurity was more prevalent among students who did not have a

private car, were dependent on their friends' or relatives' cars, or who used public transportation to access food shops. Location of food stores was also an important factor. Food price, and lack of access to quality and varied food were reasons students gave for not obtaining the quality or variety of food desired. These factors were found to significantly affect students' food security. Other factors that had a significant impact on the risk of food insecurity among the students in our study were inability of the students' accommodation to meet the student's special food needs or to provide culturally appropriate food. Experiencing difficulties in accessing food shops increased the risk of food insecurity in the students within our study. There is abundant room for further investigation and provision of support among students who are likely to be at high risk of food insecurity.

The measurement tools used to assess the prevalence of food insecurity were found to be very important. Data from this study indicated that the single item measure (Australian tool) has less specificity than the more detailed multi item measure (US tool). However, both tools failed to measure broader issues such as limited access (transport) to food, special food needs and cultural food preferences. Food insecurity dimensions are broader than financial factors alone. Therefore, development of tools that measure more than economic factors is needed. Additionally, access to food is significantly affected by personal and social environments, and the availability of an appropriate food security measurement tool that takes such factors into account has not been developed. Based on the findings of this study, the level of food insecurity might have been underestimated in the previous Australian studies and it is thus proposed that the development of an Australian tool is important and needed for

broad population studies to determine prevalence of food insecurity more accurately in the Australian context.

Food insecurity has the potential to impact on students' academic performance through heightened worry about accessing affordable and appropriate foods, as well as not having sufficient foods to perform well. The results of this study have identified a clear need to actively consider a range of assisting polices and support services for students to address food insecurity.

6. 1 Recommendations

In light of the results and conclusions derived from this study it is clear that more attention needs to be given to the food security of university students. Further research and policy options need to be considered. In terms of further research, a more detailed exploration of food security prevalence within the UOW and a comparison with other universities is needed, with an aim to increase the number of students participating to provide a more representative sample population.

More broadly on the national level, greater attention in the university sector is needed to address food security as one of the basic needs of university students in general and international students in particular. This attention could be translated to further studies to establish the prevalence of food insecurity across Australian university campuses and to assess the impact of food insecurity on students' health, well-being and academic performance. Further research could be undertaken to determine effective policies and strategies to address food insecurity in university students, particularly in relation to students' income levels and the availability and

accessibility of appropriate and good quality foods. The development of broader measurement tools is also warranted to determine the prevalence of food insecurity and the range of factors affecting it.

The findings of this study have important implications for future practice and policy at the studied university. One implication of these findings is that the UOW should establish a high level working group with a representation of student members, service providers and university executive, to focus on the food security needs of students. This group should resource in-depth exploration of students' food security issues and ways in which university policies, services and programs can act to influence food insecurity amongst its student population. It should also work with local service providers and food retailers to improve access to affordable, culturally appropriate and good quality foods.

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8 APPENDIX A THE SEARCH STRATEGY

Several sources were used to search the scholarly literature about the study aspects around food security, food access and purchasing behaviours among students. The search through scientific databases included PupMed, Embase, PsycINFO, SAGE and Medline, and the search device of UOW library (Summon) were frequently accessed. The search for articles within these databases was limited to scholarly publications in English. There was no restriction set for the publication years or full text articles. Additionally, the grey literature such as reports, theses and conference proceedings were also accessed. Australian government and education websites were also accessed to review fact sheets and statistics such as ABS and Universities Australia.

A wide range of key words were used to search within the mentioned data sources to access the relevant literature. The main search terms included food security; food insecurity; campus hunger; food access; food habits; special food needs; purchasing behaviours; food buying; university students; tertiary students; students finance; international students; immigrants food; and refugees food. Also, alternative terms were used to increase the opportunity of finding relative results, such as singular/plural form and spelling variations of some words (e.g. behaviours/behaviors).

9 APPENDIX B ETHICS APPROVAL LETTER

UNIVERSITY OF WOLLONGONG

APPLICATION APPROVAL
In reply please quote: HE12/225

28 June 2012

A/Professor Vicki Flood
Bldg 41.252
School of Health Sciences
University of Wollongong NSW 2522

Dear Associate Professor Flood

Thank you for your response dated 27 June 2012 to the HREC review of the application detailed below. I am pleased to advise that the application has been approved.

Ethics Number:	HE12/225
Project Title:	Food security among students at the University of Wollongong (UOW)
Researchers:	A/Professor Vicki Flood, A/Prof Heather Yeatman, Dr Deanne Condon-Paoloni, Mrs Reima Mansour
Approval Date:	28 June 2012
Expiry Date:	27 June 2013

The University of Wollongong/Illawarra Shoalhaven Local Health District Social Sciences HREC is constituted and functions in accordance with the NHMRC *National Statement on Ethical Conduct in Human Research*. The HREC has reviewed the research proposal for compliance with the *National Statement* and approval of this project is conditional upon your continuing compliance with this document.

A condition of approval by the HREC is the submission of a progress report annually and a final report on completion of your project. The progress report template is available at http://www.uow.edu.au/research/rso/ethics/UOW009385.html. This report must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

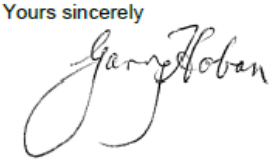
As evidence of continuing compliance, the Human Research Ethics Committee also requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforseen events that might affect continued ethical acceptability of the project.

Please note that approvals are granted for a twelve month period. Further extension will be considered on receipt of a progress report prior to expiry date.

If you have any queries regarding the HREC review process, please contact the Ethics Unit on phone 4221 3386 or email rso-ethics@uow.edu.au.

Yours sincerely



A/Professor Garry Hoban
Chair, Social Sciences
Human Research Ethics Committee

Ethics Unit, Research Services Office
University of Wollongong NSW 2522 Australia
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10 APPENDIX C STUDY QUESTIONNAIRE

Study topic: Food security among students at University of Wollongong

[Please note – the source of the question is identified in brackets (these sources were removed in the final version)]

1. Tick your gender?

   Male❑ Female❑

2. How old are you?.....Years

3. Are you?

   - ❑ Domestic student → go to Q5
   - ❑ International student → go to Q 4

4. If you are an international student, what country are you from?

   - ❑ China
   - ❑ U.S.A
   - ❑ Saudi Arabia
   - ❑ Thailand
   - ❑ India
   - ❑ Vietnam
   - ❑ Iran
   - ❑ Malaysia
   - ❑ Germany
   - ❑ South Korea
   - ❑ Other, which country? _____
   - ❑ Canada
   - ❑ Indonesia
   - ❑ Hong Kong
   - ❑ Pakistan
   - ❑ Libya
   - ❑ France
   - ❑ Japan
   - ❑ Taiwan
   - ❑ Bangladesh

5. Is English your first language?

❑ Yes ❑ No

6. How long have you been studying at the University of Wollongong?

< 3 months ❑ 3 – < 12 month❑ 1- < 2 years ❑ 2- < 3 years ❑ 3 + years ❑

7. In which suburb do you live? …….

8. In which faculty are you studying?

❑	Arts	❑	Health& Behavioural Sciences
❑	Sydney Business School	❑	Informatics
❑	Commerce	❑	Law
❑	Creative Arts	❑	Medicine
❑	Education	❑	Science
❑	Engineering	❑	SMART
❑	Other, please state.....		

9. What type of degree are you studying? (***New***)

❑ Under-graduate (e.g. Bachelor degree)

❑ Post-graduate coursework (e.g. Master's Course work)

❑ Post-graduate research (e.g. Master's or PhD)

10. Do you have a scholarship? (***New***)

❑Yes ❑ No

If yes please specify

- ❑ University fee paying only
- ❑ University fee and living expenses
- ❑ Living expenses only
- ❑ Other ……..

11. Which of the following would best describe the people who live in your household?

(Nolan et al. 2006)

- ❑ I live with my parents / relatives
- ❑ I live by myself, no children

- ❑ I live with my partner, with no children
- ❑ I live with my partner, with dependent children
- ❑ I live by myself, with dependent children
- ❑ I live in group household, unrelated adults (house/flat mates)
- ❑ More than one family living together
- ❑ Other (specify)……

12. How many people (adults and children), including yourself, usually live in your household?

(Nolan et al. 2006)

…….Number of people

13. Which of the following best describes your housing arrangements? ***(Nolan et al. 2006)***

- ❑ Rented, university accommodation
- ❑ Rented
- ❑ Living rent free
- ❑ Paying-off mortgage
- ❑ Outright owner or fully owned
- ❑ Other (specify)……..

14. Is food provided with your accommodation?

(*New*)

Meals:	Breakfast	Lunch	Dinner
Yes	❑	❑	❑
No	❑	❑	❑

15. Do you have special food needs?

(*New*)

Yes ❑ No❑

16. If your answer was yes to the previous question please tick one of the following options

❑Halal food
❑Kosher food
❑Vegetarian/Vegan
❑Food allergies/ Sensitivities, Please specify ……
❑Other please specify ……..

[If answered yes in Q 14. link to Q17]

17. Does the food provided at your accommodation meet your special needs?

(*New*)

❑ Yes ❑ No ❑ Not applicable

18. Do you purchase your own food?

❑ Yes all food
❑ Yes some food
❑ Yes a little food
❑ No (***New***)

19. Where do you purchase your own food? (Please write names of supermarkets, local stores or other stores)

(***New***)

Fruit/ vegetables: Supermarket:…….....
Local store:……..……
Other:……..

Meat: Supermarket:…….
Local store:……
Other:……

Groceries: Supermarket:…….
Local store:……
Other:……

20. If you need special food, where do you purchase it from?

(***New***)

- ❑ Supermarket
- ❑ Local store

Other locations. Please specify where:

……

- ❑ Not applicable
- ❑ I have not bought any special food

21. How do you normally get to and from the shops to buy food ?(tick all methods used)

(Nolan et al. 2006)

- ❑ Bus
- ❑ Train
- ❑ Own car
- ❑ Friend's car
- ❑ Relatives' car
- ❑ Taxi
- ❑ Walk
- ❑ Bicycle
- ❑ Other…….

22. How difficult is it for you to get to and from the shops to buy food, using your normal mode/s of transport? ***(Nolan et al. 2006)***

- ❑ Very difficult
- ❑ A little difficult
- ❑ Not difficult at all

What makes it difficult?

.....

……

The following statements include reasons why people do not always have the quality or variety of food they want. For each one please identify if this is a reason why you don't always have the kinds of food you want to eat.

MULTIPLE RESPONSES ALLOWED

Reasons for not obtaining quality or variety of food desired	Always	Occasionally	Seldom
Location of food stores	❑	❑	❑
Availability of healthy foods	❑	❑	❑
Availability of culturally appropriate foods	❑	❑	❑
Price of food	❑	❑	❑
Quality of food	❑	❑	❑
Variety of food	❑	❑	❑
Not enough time for shopping or cooking	❑	❑	❑

(Nolan et al. 2006)

23. Which of the following factors affect your ability to access and eat the food you/your household needs? MULTIPLES RESPONSES ALLOWED

(Nolan et al. 2006)

- ❑ Distance to food shops
- ❑ Reliable and adequate public transport
- ❑ Knowledge and cooking skills to prepare healthy meals
- ❑ Food storage room and cooking equipment available at home
- ❑ Space to prepare food and cooking facilities (e.g. stove, oven, microwave) at home
- ❑ Adequate time to shop, prepare and cook food
- ❑ Mobility to shop and cook food
- ❑ Not applicable

24. What would you suggest should occur to make it easier for university students to access the amounts and type of foods required for your needs? (***New***)

.....

.....

.....

The next few questions are in a sensitive area of research but this information is important to understand the different factors which may affect access and availability of food.
Some of the questions and statements in this section appear repetitive but they are part of a series of questions that have been used in other surveys and it will be useful for us if you can answer all of the questions.

---

25. In the last 12 months, or since you started studying at the university if this is less than 12 months, were there any times that you ran out of food and could not afford to buy more? (Rychetnik et al. 2003; ABS 2011)

❑ Yes ❑ No

26. (If your answer was yes to the previous question) When this happened did you go without food? (Rychetnik et al. 2003; ABS 2011)

❑ Yes ❑ No

27. How often have the following statements been true for you in the last 12 months or since you started studying at the university if this is less than 12 months?

Questions	Often	Sometimes	Never
I feel stressed because I can't provide the food I want for social occasions (Russell et al. 1999)	❑	❑	❑
I worry whether my food will run out before I get money to buy more (Bickel et al. 2000)	❑	❑	❑
The food that I bought just didn't last, and I didn't have money to get more (Bickel et al. 2000)	❑	❑	❑
I couldn't afford to eat balanced meals (Bickel et al. 2000)	❑	❑	❑

28. Did you ever cut the size of your meals or skip meals because there wasn't enough money for food? (Bickel et al. 2000)

❑Yes
❑ No

29. [IF YES ABOVE] How often did this happen? (Bickel et al. 2000)
    - ❑ Almost every month
    - ❑ Some months but not every month
    - ❑Only 1 or 2 months

30. Did you ever eat less than you felt you should because there wasn't enough money to buy food? (Bickel et al. 2000)
    - ❑ Yes
    - ❑ No

31. Were you ever hungry but didn't eat because you couldn't afford enough food? (Bickel et al. 2000)
    - ❑ Yes
    - ❑ No

32. Did you ever not eat for a whole day because there wasn't enough money for food? (Bickel et al. 2000)
    - ❑ Yes
    - ❑ No

33. [IF YES ABOVE] How often did this happen? (Bickel et al. 2000)
    - ❑ Almost every month
    - ❑ Some months but not every month
    - ❑Only 1 or 2 months

34. Did you lose weight because you did not have enough money for food? (Bickel et al. 2000)
    - ❑ Yes
    - ❑ No

35. Do you have employment? (***New***)

    ❑ Yes ❑ No

    If yes what is the average hours per week that you work? ……

36. What is your monthly income?

- ❑ Less than $1,000
- ❑ $1,000-$2,999
- ❑ $3,000-$4,999
- ❑ $5,000-$5,999
- ❑ $6,000-$7,999
- ❑ $8,000-$8,999

Other please specify.....

If you have children please answer the following questions

(Bickel et al. 2000)

37. How many children under the age of 18 usually live in your household?

_____ number of children

38. In the last 12 months, did your child /any of your children ever skip meals because there wasn't enough money for food?

- ❑Yes
- ❑ No

39. How often has the following statement been true for you in the last 12 months, or since you started studying at the university if this is less than 12 months?

My child /children did not eat enough because I just couldn't afford enough food

- ❑ Often true
- ❑ Sometimes true
- ❑ Never true

40. [IF YES ABOVE ASK] How often did this happen?

- ❑ Almost every month
- ❑Some months but not every month
- ❑ Only 1 or 2 months

41. In the last 12 months, or since you started studying at the university if this is less than 12 months, did your child/any of the children ever not eat for a whole day because there wasn't enough money for food?

- ❑ Yes
- ❑ No

11 APPENDIX D LETTER TO THE CLUBS AND ASSOCIATIONS

Dear [Secretary, Student Club],

My name is Reima Mansour. I am a Master's Research student in the Faculty of Health and Behavioural Sciences at the University of Wollongong, under the supervision of Associate Professors Vicki Flood, Heather Yeatman and Dr Deanne Condon-Paoloni (School of Health Sciences). I am conducting a research study as part of the requirements for my degree in Master of Sciences Research. The purpose of the research is to investigate the factors influencing food security (availability, accessibility and affordability) among students attending the University of Wollongong.

I need your permission to send my online questionnaire to your members or organize a meeting to discuss this. Your agreement will be highly appreciated and this research will help to understand the specific issues faced by university students in relation to food access, availability and affordability. I will be contacting you over the next few days to discuss this.

If you require further information, I can be contacted by telephone (0422341014) or by email; rmm009@uowmail.edu.au.

Students will be asked to complete an online questionnaire that will take about 10 - 15 minutes. The questionnaire includes items to collect demographic information, questions about food access and buying habits and food experiences during the last 12 months or since you started studying at the university.

Students also will be informed about the study via flyers and notices on notice boards within the university.

I have ethics approval (HE12-225) for this study. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UOW Ethics Officer on (02) 4221 3386 or email rso-ethics@uow.edu.au.

I look forward to talking to you about this study.

Kind regards

Reima Mansour

12 APPENDIX E INVITATION LETTER TO THE STUDENTS

Dear fellow student,

I am writing to ask you to complete a questionnaire about the food security of university students and whether you experience any problems yourself with food availability, access or affordability. The questionnaire is completely anonymous and will only take about 10-15 minutes to complete.

I am doing this study as part of my Master of Science in Research. My lead supervisor is A/Professor Vicki Flood in Health Sciences and I have ethics approval (HE12-225). The more students who participate, the better for the research findings and more information will also help us to support future students.

The questionnaire can be accessed by the SurveyMonkey tool below:

https://www.surveymonkey.com/s/ZVWLHCF

You will need to read the information then at the bottom of the page click "next" to take you into the questionnaire.

Thanks so much for your help.

Kind regards
Reima Mansour, B.S. (Nutrition)
Candidate for a Master's degree in Health Science, School of Health Science, Faculty of Science, University of Wollongong.

13 APPENDIX F PARTICIPANT INFORMATION SHEET FOR UNIVERSITY STUDENTS

PARTICIPANT INFORMATION SHEET FOR UNIVERSITY STUDENTS

TITLE: Food insecurity among students at UOW

PURPOSE OF THE RESEARCH

This is an invitation to participate in a study conducted by researchers at the University of Wollongong. The purpose of the research is to investigate the factors influencing food security (availability, accessibility and affordability) among students attending the University of Wollongong.

INVESTIGATORS:

Reima Mansour

(Master of Science, Research Student)

Faculty of Health and Behavioural Sciences

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rmm009@uow.edu.au

Associate Professor Vicki Flood

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Dr Deanne Condon-Paoloni

Faculty of Health and Behavioural Sciences

02 4221 4597

deannecp@uow.edu.au

METHOD AND DEMANDS ON PARTICIPANTS

If you choose to participate in this study, you will be asked to complete an online questionnaire that will take about 10 -15 minutes. The questionnaire includes items to collect demographic information, questions about food access and buying habits and food experiences during the last 12 months or since you started studying at the university. Typical questions in the questionnaire include: Is food provided with your accommodation? How do you normally get to and from the shops to buy food? Did you ever cut the size of your meals or skip meals because there wasn't enough money for food? Were you ever hungry but didn't eat because you couldn't afford enough food?

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 15 minutes of your time to complete the questionnaire we can foresee no risks for you. The questionnaire is anonymous and your involvement in the study is voluntary. You may withdraw your participation from the study at any time during completion of the questionnaire and withdraw any data that you have provided to that point. Refusal to participate in the study will not affect your relationship with the University of Wollongong.

FUNDING AND BENEFITS OF THE RESEARCH

This research will help to understand the specific issues faced by university students in relation to food access, availability and affordability. Findings from the study will be published in a peer-thesis and in peer-reviewed journals. Confidentiality is assured as the questionnaire is anonymous. You are not asked to provide any identifying information about yourself. Data will be grouped into categories of responses such as men and women, and domestic and international students.
This research is not supported by a research grant, however the student researcher is in receipt of a scholarship.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social

Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UOW Ethics Officer on (02) 4221 3386 or email rso-ethics@uow.edu.au.

Thank you for your interest in this study.

14 APPENDIX G FLYER TO THE STUDENTS

Would you like to help improve food access for UOW students?

A questionnaire is being conducted to investigate the factors influencing food security (availability, accessibility and affordability) among students attending the University of Wollongong.

You will be asked to complete an online questionnaire that will take about 10 -15 minutes. The information you provide will be treated as confidential and the questionnaire will be anonymous.

Your participation will be highly appreciated and will also help us to support future students.

If you are interested in taking part in this study, you can access an online version: **https://www.surveymonkey.com/s/ZVWLHCF**. For further information, contact Ms Reima Mansour, Master of Science Student, School of Health Sciences, University of Wollongong. Email: rmm009@uowmail.edu.au

15 APPENDIX H (TABLE) FOOD SECURITY STATUS OF CHILDREN IN RELATION TO THE DEMOGRAPHIC ATTRIBUTES OF THE STUDENTS' HOUSEHOLDS (MULTI ITEM MEASURES)

Factors	**Total (n 78)**	**Food insecurity measure**	
		n	**Children FI (%)**
Gender			
Male	29	6	(20.7)
Female	49	2	(4.1)
Nationality			
Domestic	35	2	(5.7)
International	43	6	(14.0)
First language			
English	34	2	(5.9)
No	44	6	(13.6)
Period of study			
<2 years	28	5	(17.9)
2-< 3 years	21	2	(9.5)
3+ years	29	1	(3.4)
Faculties			
Arts, Creative Arts, Law.	6	0	(0.0)
Sydney Business School, Commerce.	8	1	(12.5)
Engineering, Informatics.	23	4	(17.4)
Health & Behavioural Sciences, Medicine, Science.	35	3	(8.6)
Education	5	0	(0.0)
Type of study			
Under-graduate /Post-graduate coursework	32	5	(15.6)
Post-graduate research	46	3	(6.5)
Age groups			
18 – 34 years	38	2	(5.3)
35 +years	37	6	(16.2)
Area of residence			
Illawarra	72	7	(9.7)
Sydney	6	1	(16.7)
Number of people in the household			
1 - 5	69	6	(8.7)
6+	9	2	(22.2)
No. Children *among people who have children*			
1-2	62	7	(11.3)
>3	16	1	(6.3)
Area of origin **[1]			
Australia	35	2	(5.7)
Middle East	31	6	(19.4)
Asia	12	0	(0.0)

*[1] There is no other

16 APPENDIX I (TABLE) FOOD SECURITY STATUS OF CHILDREN IN RELATION TO ECONOMIC FACTORS (MULTI ITEM MEASURES)

Factors	**Total (n 78)**	**Food insecurity measure using multi item measures**	
		n	**Children FI (%)**
Employment status			
Yes	31	2	(6.5)
No	46	6	(13.0)
Income/month			
< $1000	18	2	(11.1)
$1000- $4.999	51	6	(11.8)
$5000- $ 9000+	6	0	(0.0)
Scholarship			
Yes	51	7	(13.7)
No	26	1	(3.8)
Housing arrangements			
Renting	48	5	(10.4)
Others	30	3	(10.0)

17 APPENDIX J (TABLE) FOOD SECURITY STATUS OF CHILDREN IN RELATION TO FOOD ACCESS AND AVAILABILITY (MULTI ITEM MEASURES)

Food access and availability factors	Total (n 78)	Food insecurity measure	
		n	Children FI (%)
Reasons given for not obtaining quality or variety of food desired			
Location of food stores			
Always/ Occasionally	41	6	(14.6)
Seldom	32	1	(3.1)
Price of food			
Always/ Occasionally	56	6	(10.7)
Seldom	19	1	(5.3)
Availability of healthy food			
Always/ Occasionally	38	6	(15.8)
Seldom	34	1	(2.9)
Availability of culturally appropriate foods			
Always/ Occasionally	40	6	(15.0)
Seldom	34	1	(2.9)
Quality of food			
Always/ Occasionally	53	6	(11.3)
Seldom	21	1	(4.8)
Variety of food			
Always/ Occasionally	48	7	(14.6)
Seldom	24	0	(0.0)
Not enough time for shopping or cooking			
Always/ Occasionally	53	5	(9.4)
Seldom	21	2	(9.5)
Other factors			
Special food needs			
Yes	41	5	(12.2)
No	37	3	(8.1)
Food provided by the accommodation meets participants' special needs			
Yes	21	2	(9.5)
No	6	3	(50)
Transport type			
Own car	65	5	(7.7)
Other methods*[1]	13	3	(23.1)
Purchase own food			
Yes (All/Some)	71	8	(11.3)
No /Little	7	0	(0.0)
Difficulties to get to and from the shops			
Some difficulties (Very difficult / A little difficult)	22	5	(22.7)
No difficulties	54	3	(5.6)

*[1] Bus, walk, train, bicycle, friends' car, relatives' car, taxi

18 APPENDIX K (TABLE) KEY STUDENTS' SUGGESTIONS REGARDING FACILITATING FOOD ACCESS

Students' suggestion	Total n=197 missing= 140	(%)
Make food and water more affordable with more of a healthier choice of meals on campus or make students discounts/ voucher/ food subsidies.	80	(40.6)
Small food stores/ supermarket for fresh food and groceries at UOW campuses	37	(18.8)
Availability of special food (Halal, Vegetarian, traditional, allergic) on main and innovation campus and availability of *halal* meat at big supermarkets.	34	(17.3)
Book/ website/ workshop to guide students for shopping, cooking healthy cheap, simple recipes, shops map.	14	(7.1)
Improve free bus access to various food shops	13	(6.6)
More option supermarkets at different areas	7	(3.6)
Increase food stores or restaurant opening hours at UOW or in Wollongong	6	(3.0)
Kitchen to store (Fridge) and reheat ready students' food on university campuses.	3	(1.5)
University garden project to sell fresh vegetables at UOW.	2	(1.0)
Clear labels outlining ingredients at UOW food services providers.	1	(0.5)