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Vol: 1, Issue: 3

Food and Nutrition Report

Factors Associated with Stress among First-year Undergraduate Students Attending an Australian University

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Article Type: Research, **Submission Date**: 21 April 2016, **Accepted Date**: 11 May 2016, **Published Date**: 25 May 2016.

Citation: Patricia C. Lee, Faruk Ahmed, Thanya Pathirana and Keren Papier (2016) Factors Associated with Stress among First-year Undergraduate Students Attending an Australian University. F Nutr Reprt 1(3): 17-24. doi: https://doi.org/10.24218/fnr.2015.13.

Abstract

Objective: The aim of this study was to examine the relationship between stress and various socio-demographic, health and behavioural factors among undergraduate students studying in an Australian university.

Methods: A cross-sectional survey was carried out among first-year undergraduate students studying at Griffith University. Participants were recruited from four different academic groups (N=728). The questionnaire used in this study comprised of three sections: socio-demographic information, stress scale and a food frequency questionnaire. K-means Cluster analysis was performed to identify the major dietary patterns and multinomial logistic regression analysis was used to examine the factors associated with stress.

Results: Nearly 53% of the students had some degree of stress with 37.4% experiencing moderate to severe levels of stress. The factors most strongly associated with having mild or moderate/severe stress levels included being in a relationship [OR =1.71, 95% CI (1.02-2.87) and OR=1.61, 95% CI (1.06-2.44)], studying a non-health related degree [OR=1.68, 95% CI (1.03-2.73) and OR=1.51, 95% CI (1.04-2.19)], working ≥ 21 hours per week [OR=2.12, 95% CI (1.02-4.40) and OR=2.21, 95% CI (1.32-3.67)], and engaging in an unhealthy dietary pattern [OR=2.67, 95% CI (1.25-5.72) and OR=2.76, 95% CI (1.47-5.16)]. Being a female [OR=1.84, 95% CI (1.25-2.72)], living in a shared accommodation [OR=0.52, 95% CI (0.27-0.98)], rarely exercising [OR=2.64, 95% CI (1.59-4.39)], having a body mass index (BMI) of 25 or over [OR=2.03, 95% CI (1.36-3.04)], and engaging in a dietary pattern that was low in protein, fruit and vegetables [OR=1.72, 95% CI (1.06-2.77)] were also associated with having moderate/severe stress levels.

Conclusion: This study found that more than half of the undergraduate students had some levels of stress. Both mild and moderate/severe levels of stress were associated with socio-demographic characteristics, risky health behaviours and poor dietary patterns. Our findings reinforce the need to promote healthy behaviours among undergraduate university students in order to maintain good mental health.

Keywords: Stress, Factors, Dietary pattern, University students, Australia.

Introduction

According to the most recent national survey of mental health and wellbeing (NSMHWB) conducted in Australia, mental health disorders affect nearly half of the Australian population, with the highest prevalence observed among young adults aged between 16-24 years [1]. With a large proportion of these young adults attending tertiary institutions, there is growing concern that university students are highly vulnerable to developing mental health-related problems. Recent studies conducted among Australian university students have found that the majority of students suffered from some level of stress, with the estimates from these studies having surpassed those observed in the general Australian population [2,3]. This is concerning since stress can have a negative impact on students' academic achievements, and adverse effects on their psychological and physical well-being later on in life [4].

Several key factors have been identified as potential stressors in university life. The transition from the familiar school setting to a university environment has been found to be challenging in terms of higher academic requirements together with greater time pressures, financial demands and less time left for recreational activities [2,3]. Examination and assignment periods have also been commonly identified as highly stressful times for university students [5]. The other common factors or stressors identified by previous studies included socio-demographic factors such as age, ethnicity/race, financial pressure, accommodation-related problems, health and lifestyle factors (including perceived physical health problems, being overweight/obese, exercise, changes in sleep pattern and substance use), and academic factors including academic discipline/group, year of study, academic

performance, part-time/full-time status [3,6-9].

Apart from the common socio-demographic factors and traditional stressors, there are several studies in the literature suggesting that dietary habits are deemed to be a key factor influencing mental health [7,10-11]. Conversely, the association has also been observed in the opposite direction, that is, stress has been found to be associated with poor food selection [12-14], but results are not always consistent [15,16]. In a recent study, we demonstrated that stress was associated with unhealthy food selection among university students, with stress being a more significant predictor of unhealthy food selection among male students [17]. Others have also shown that inadequate nutrition and poor diet quality were likely to be directly associated with mental health problems [10-11]. It has been suggested that a total diet pattern analysis would be required to identify the interactive effects of various nutrients on mental health problems in order to understand the possible mechanisms underpinning this relationship [18-19].

To date little research has investigated the interactive effects of specific dietary patterns/ different nutritional habits, health-related factors (such as exercise and smoking) as well as other potential contributory factors such as diverse personal and socio-demographic characteristics of university students on their stress outcome. Given the serious health consequences of stress, there is a need for developing strategies to reduce the risk of stress among university students and thus warrants identifying the possible risk factors of stress in this population group. The present study was conducted to address these gaps in the existing research especially with regard to an Australian context where such evidence is considerably limited. Thus, the purpose of this study was to examine the association of various socio-economic, health and behavioural factors including dietary patterns with stress among first-year undergraduate students attending an Australian university.

Materials and Methods

Study Design and Participants

A cross sectional study design, using purposive sampling, was employed to collect data from first-year undergraduate students studying at the Gold Coast campus of Griffith University, Australia. Griffith University has 5 campuses across the Brisbane and Gold Coast regions. The selection of this campus was based on its diverse academic cohort and because it is the biggest of the 5 campuses. All students enrolled in the selected schools were approached in their lecture halls during week 10 to week 13 of the 2nd semester of 2012 and during weeks 10-13 of the 1st semester in 2013. These two periods were chosen because these are the two most stressful periods of the academic year. All of the students were informed about the purpose of the research at the beginning of their lecture and a self-administrated questionnaire was distributed to any interested student. In this way, 800 first year students were approached and 728 participated in this study. The overall response rate was 91.0%. The study was approved by the Griffith University Human Research Ethics Committee prior to the data collection. The methods for this study have been described in more detail elsewhere [17].

Data Collection

The questionnaire was pre tested with the same cohort prior to being finalized. The questionnaire was comprised of the following three sections:

Section 1: Socio-demographics: This section gathered information on: 1) area of study and study status; 2) socio-demographic data such as age, sex, marital status, living situation; 3) hours worked per week, 4) anthropometric and health related data (e.g. body weight and height, exercise, weight loss and smoking).

Section 2: Stress Assessment: The stress sub-scale of the Depression Anxiety Stress Scale (DASS) version 21 was used to assess the stress among the participants. The DASS has been validated repeatedly for different populations [20]. The DASS scale uses a 4-point Likert scale to rate the degree of stress experienced by participants' during the previous once week period [20].

Section 3: Dietary Intake: The Commonwealth Scientific and Industrial Research Organization (CSIRO) Food Frequency Questionnaire (FFQ) was used to assess the dietary patterns of the study participants. The CSIRO FFQ was validated among the Australian adult population [21-22]. Information on the frequency of intake of selected food items was assessed based on the students' previous one-week period using an 8-point scale. No information was collected on the portion size. The food items were classified as the following ten food categories: cereal foods, meat and chicken, fish and seafood, dairy and eggs, meat alternatives, vegetables and fruit, processed food, extras and highly processed food, beverages and alcoholic beverages. The detailed food items under each category are shown in Table 1. The total consumption of each food category was calculated by adding up the daily intake amounts of all food items listed under the category.

Table 1: Detailed food items under the main food categories used in the food frequency questionnaire

Food category	Items
Cereal foods	White rice pasta, brown rice pasta, white bread, brown bread, plain rice crackers
Meat and chicken	Meat, chicken
Fish and seafood	Fish, seafood, canned tuna/salmon
Dairy and eggs	Hard cheese, soft cheese, yogurt (unsweetened), egg, full fat milk, reduced skim fat milk
Meat alternatives	Lentils beans, tofu tempeh, unsalted nuts, soy milk,
Vegetables and fruit	Leafy vegetables, starchy vegetables, fruit
Processed food	Nuggets, hot chips, hamburger with bun, meat pie/ sausage roll, sausage kebab, pizza
Extras and highly processed food	Dressing, sauce, spread, ice cream popsicle, cake, biscuits, sweetened cereal, chocolate/muesli bar, crisps, salted nuts, lollies
Beverages	Energy drinks, fizzy drink, diet fizzy drink, pure fruit juice, fruit drink cordial, flavoured milk, tea, coffee
Alcoholic beverages	Beer, mixed drink, wine/champagne, spirits

Table 2: Socio-demographic, health and behaviour related characteristics of the study participants by severity of stress level

	Total	Stress Level			
		Normal	Mild	Moderate/Severe	
Variable	n (%)	n (%)	n (%)	n (%)	P*- value
	728 (100)	343 (47.1)	113 (15.5)	272 (37.4)	
Age group (Year) (Mean/SD)	21.34 (2.9)	21.24 (2.8)	21.32 (2.7)	21.48 (3.1)	
18-20	306 (48.0)	151 (49.3)	46 (15.0)	109 (35.7)	0.353
21+	331 (52.0)	145 (43.8)	52 (15.7)	134 (40.5)	
Sex					
Male	331 (45.5)	174 (52.6)	51 (15.4)	106 (32.0)	0.015
Female	397 (54.5)	169 (42.6)	62 (15.6)	166 (41.8)	
Marital status					
Single/Separates/Divorced	541 (74.9)	275 (50.8)	77 (14.2)	189 (35.0)	0.008
Married/Partnership	181 (25.1)	68 (37.6)	35 (19.3)	78 (43.1)	
Academic group					
Arts, education & law	170 (23.7)	64 (37.6)	28 (16.5)	78 (45.9)	0.001
Health	306 (42.7)	174 (56.9)	44 (14.4)	88 (28.7)	
Business	130 (18.2)	51 (39.2)	27 (20.8)	52 (40.0)	
SEET	110 (15.4)	54 (49.1)	14 (12.7)	42 (38.2)	
Study status					
Domestic	604 (83.7)	286 (47.4)	90 (14.9)	228 (37.7)	0.821
International	118 (16.3)	56 (47.5)	20 (16.9)	42 (35.6)	
Living situation					
On-campus accommodation	64 (8.9)	27 (48.0)	4 (6.3)	33 (51.7)	0.057
Off-campus/shared accommodation	330 (45.6)	162 (49.1)	56 (17.0)	112 (33.9)	
At home with family	329 (45.5)	153 (46.5)	52 (15.8)	124 (37.7)	
Working hours/week (payed employment)					
0	170 (23.5)	101 (59.4)	19 (11.2)	50 (29.4)	0.008
1-10	206 (28.5)	87 (42.2)	29 (14.1)	90 (43.7)	
11-20	260 (35.9)	112 (43.1)	48 (18.5)	100 (38.4)	
21+	88 (12.1)	41 (46.6)	17 (19.3)	30 (34.1)	
Exercise (times/week)					
Never or rarely	136 (18.8)	43 (31.6)	24 (17.6)	69 (50.8)	0.001
1-2	230 (31.7)	97 (42.2)	34 (14.8)	99 (43.0)	
≥3	359 (49.5)	202 (56.3)	54 (15.0)	103 (28.7)	
BMI kg/m^2					
<25	494 (69.6)	252 (51.0)	77 (15.6)	165 (33.4)	0.001
≥25	216 (30.4)	81 (37.5)	33 (15.3)	102 (47.2)	
Trying to lose weight					
Yes	268 (36.8)	119 (44.4)	46 (17.2)	103 (38.4)	0.466
No	460 (63.2)	224 (48.7)	67 (14.6)	169 (36.7)	
Smoking status					
Smoker	50 (6.9)	20 (40.0)	10 (20.0)	20 (40.0)	0.504
Non-smoker	678 (93.1)	323 (47.6)	103 (15.2)	252 (37.2)	
Dietary cluster					
Cluster 1 (Low protein, fruit & vegetables)	454 (62.8)	216 (47.6)	63 (13.9)	175 (38.5)	0.001
Cluster 2 (Unhealthy)	119 (16.5)	37 (31.1)	26 (21.8)	56 (47.1)	
Cluster 3 (Healthy)	150 (20.7)	89 (59.3)	23 (15.3)	38 (25.4)	

*Based on Chi-square test

Data Analysis

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS/PASW) version 22.0. In order to reduce the complexity of identifying major dietary patterns from various combinations of 10 different food categories listed in the FFQ, a K-means Cluster analysis was applied to reveal the natural groupings among the university participants. The defined groups were then used to determine key dietary patterns. The cluster solution utilised closest distance as a criterion to define groups within which participants having similar frequencies of intake of certain food categories should fall into the same cluster while participants far apart should be in different clusters. The patterns were determined based on the relatively high frequency consumption of foods that are seen as healthy (Cluster 3, high in fruits/vegetables and meat alternatives, and low in processed/ highly processed foods) or unhealthy food categories (Cluster 2, high in cereal, processed/ highly processed foods, alcoholic and non-alcoholic beverages) and relatively low consumption of protein and fruit/vegetables (Cluster 1).

Descriptive analyses and chi-square tests were carried out to present frequency distributions of selected variables. These included: socio-demographic characteristics such as age, sex, marital status, academic group, study status, and living situation, and behavioural risk factors such as working hours per week, frequency of exercise, body mass index (BMI), trying to lose weight, smoking status and dietary pattern (cluster) and to assess their associations with stress levels. Stress level was categorised into "no stress", "mild stress" and "moderate/severe stress" (moderate, severe and extremely severe were combined) using the cut-off scores defined in the DASS Manual [23]. Multinomial logistic regression analysis was performed to assess the relationship between stress level (dependent variable) and various socio-demographic variables (sex, marital status and living situation), academic (academic group, study status), health and behavioural risk factors (BMI, working hours per week, exercise, smoking, trying to lose weight and dietary pattern). Age was excluded in the logistic regression modelling due to a large proportion (approximately 13%) of missing values in the study sample. Odds ratios and 95% confidence intervals (95% CIs) were calculated to estimate the likelihood of the presence of stress. Statistical significance was set at $p<0.05$.

Results

Table 2 depicts the distributions of the participants' socio-demographic characteristics and some common health and behavioural risk factors in relation to stress status. Of the 728 first-year students, 45.5% (331) were males and 54.5% (397) were females. Mean (±SD) age of the participants was 21.3 (±2.9) years. Nearly 75% of all participants were single (including separated or divorced) and the rest were married or living with partner. A large proportion (83.7%) of the participants was domestic students. Over half (54.5%) of the students were living on their own (or sharing accommodation) and the rest were living with family. More than 40% of the participants enrolled in programs under the Health Group, whereas 23.7%, 18.2% and 15.4% of them enrolled in Arts, Education and Law, Business and SEET (Science, Environment, Engineering and Technology) respectively. Chi-square test results showed that a significantly higher proportion of female, married/partnered, non-health group participants experienced some levels of stress (p = 0.015, 0.008 and 0.001 respectively) compared with male students, participants who were single, and those participants studying in health.

Of the participants, 385 (52.9%) had some degree of stress (from mild to extremely severe stress) with 272 (37.4%) experiencing a high level of stress. About half (48%) of the students were studying part-time and worked for more than 10 hours per week, while others were full-time students or working less than 10 hours per week. Nearly half (49.5%) of the participants reported doing physical exercise more than 3 times a week, another 31.7% reported doing physical exercise 1-2 times a week and the rest (18.8%) reported either never or rarely doing exercise. The prevalence of overweight and obesity (BMI≥25) in the study sample was 30.4%. Over one third (36.8%) of the participants reported that they tried to lose weight and about 7% of the participants were smokers. The participants who had part-time jobs (p=0.008) and exercised less frequently (p<0.001) were more likely to be stressed. Overweight or obesity (BMI≥25) was found to be associated with moderate or severe levels of stress (47.2% in high BMI group but only 33.4% in normal BMI group; p=0.001).

The initial cluster analysis yielded five groups of dietary patterns based on the 10 food categories. All of the 10 food categories made significant contributions in the clustering process (all p<0.001 in F tests). Two small clusters with only one observation were excluded due to extreme values or outliers identified in several food categories. The remaining three clusters, included in the analysis, were classified as the following dietary pattern groups: "Cluster 1: low in protein, fruit and vegetables", "Cluster 2: unhealthy- high in processed/ highly processed foods and alcoholic and non-alcoholic beverages" and "Cluster 3: healthy-high in fruit/ vegetables and meat alternatives". The comparison of the patterns of food consumption based on group means of the 10 food categories in the three clusters is presented in Figure 1.

The majority (62.8%) of the participants adhered to the Cluster 1 dietary pattern (relatively low protein, fruits and vegetables) whereas only one fifth of the participants were classified in healthy dietary group (Cluster 3). It is noted that nearly half (47.1%) of the unhealthy dietary group participants and over one third (38.5%) of the Cluster 1 participants suffered from a high level of stress (moderate to severe levels); whereas the majority (59.3%) of the healthy dietary group participants had no stress (p value<0.001; Table 2).

Table 3 presents the final model of the multinomial logistic regression. There were two parts in the modelling process developed to predict mild and moderate/severe levels of stress outcome. The results in part 1 showed that the students who were married/in partnership, studying in non-health academic groups, working over 11 hours/week and engaging in an unhealthy dietary pattern were at a higher risk of suffering from mild stress levels. In part 2, female sex, married/in partnership, studying in non-health academic groups, , working over 20 hours/week, physical inactivity, higher BMI (≥25 kg/m^2), and having an unhealthy dietary pattern and a diet in low protein, fruit and vegetables were at higher risk of suffering from moderate to severe levels of stress. Students who were living off-campus/ shared accommodation had significantly lower risk of moderate

Table 3: Odds ratios for various risk factors associated with stress levels in the study participants

	Part 1 (Odds of having mild stress)		Part 2 (Odds of having moderate/severe stress)	
Variables in Model	**Adjusted OR (95%CI)**	***p**- value*	**Adjusted OR (95%CI)**	***p**- value*
Sex				
Male	1	-	1	-
Female	1.56 (0.94-2.60)	0.085	1.84 (1.25-2.72)	0.002
Marital status				
Single/Separates/Divorced	1	-	1	-
Married/ Partnership	1.71 (1.02-2.87)	0.044	1.61 (1.06-2.44)	0.026
Academic group				
Health Group	1	-	1	-
Other	1.68 (1.03-2.73)	0.039	1.51 (1.04-2.19)	0.031
Study status				
Domestic	1	-	1	-
International	1.22 (0.63-2.38)	0.561	0.90 (0.53-1.55)	0.706
Living status				
On-campus accommodation	1	-	1	-
Off-campus/ shared accommodation	1.99 (0.64-6.24)	0.236	0.52 (0.27-0.98)	0.043
At home with family	1.81 (0.57-5.73)	0.316	0.60 (0.31-1.14)	0.115
Working hours/week				
0	1	-	1	-
1-10	2.33 (0.98-5.57)	0.057	1.49 (0.77-2.90)	0.241
11-20	2.49 (1.25-4.96)	0.009	1.46 (0.88-2.44)	0.145
21+	2.12 (1.02-4.40)	0.044	2.21 (1.32-3.67)	0.002
Exercise (times/week)				
≥3	1	-	1	-
1-2	1.00 (0.58-1.74)	0.988	1.37 (0.90-2.08)	0.143
Never or rarely	1.87 (0.96-3.65)	0.065	2.64 (1.59-4.39)	0.001
BMI/kg^2				
<25	1	-	1	-
≥25	1.22 (0.71-2.08)	0.468	2.03 (1.36-3.04)	0.001
Dietary pattern				
Cluster 3 (Healthy)	1	-	1	-
Cluster 1 (Low protein, fruit and Vegetables)	1.25 (0.68-2.29)	0.471	1.72 (1.06-2.77)	0.027
Cluster 2 (Unhealthy)	2.67 (1.25-5.72)	0.011*	2.76 (1.47-5.16)	0.002

* Based on multinomial logistic regression.

to severe levels of stress compared to those who were living on-campus accommodation.

Discussion

In light of the rapid rise in mental health problem in young adults, an increasing body of literature has sought to examine prevalence of stress among university students [2-3,6-7,17,24-25].Building on the previous studies, the present study focused on identifying the potential risk factors of stress among undergraduate university students attending an Australian University. This study found that sex, marital status, academic group, weekly working hours, frequency of exercise, overweight/obesity and dietary patterns were significant predictors of different levels of stress and thus indicating a complex relationship of various socio-demographic, health and behavioural factors with stress.

The students who experienced unhealthy dietary patterns were 2-3 times more likely to suffer from both mild and moderate to severe levels of stress compared with those who maintained a healthy dietary pattern. The association between engaging in an unhealthy dietary pattern and mental health status may be in part attributed to the biochemical properties of particular dietary nutrients [26]. Previous studies indicated that intake of foods high in fat, sugar or salt may activate the endogenous opioid

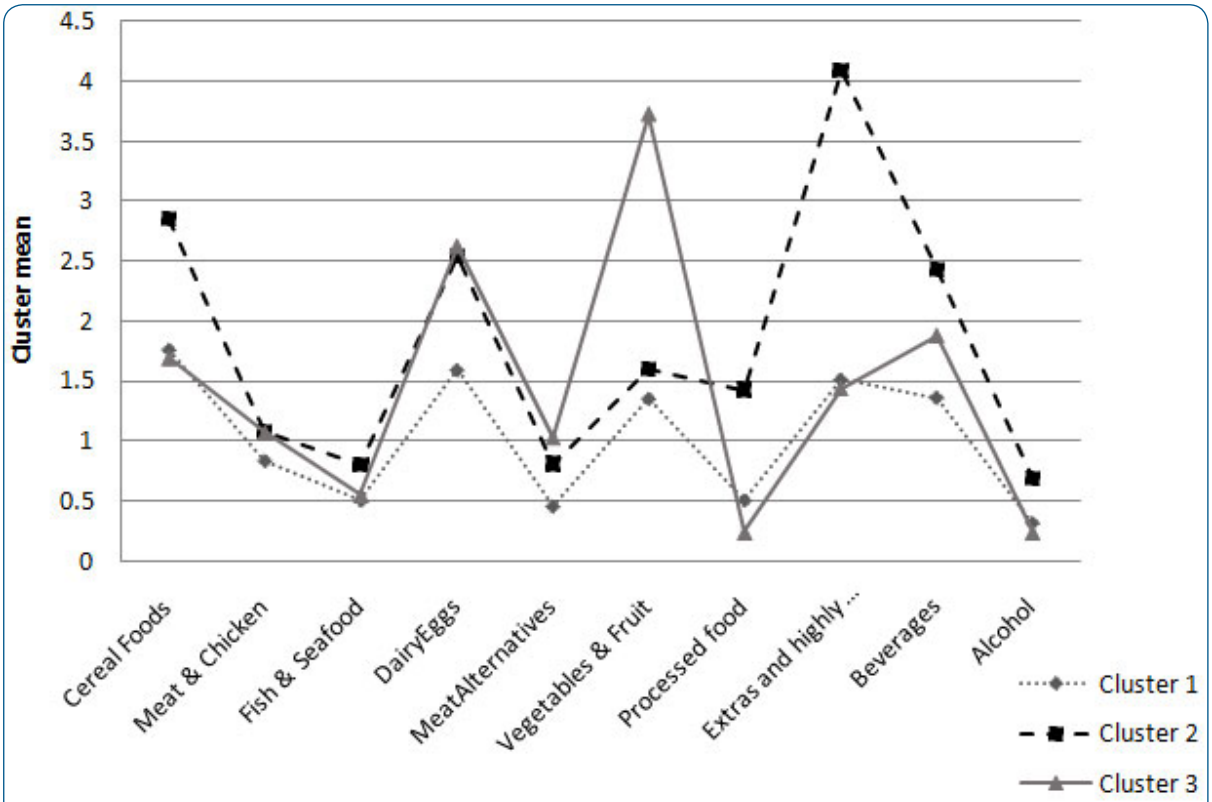

Figure 1: Mean consumptions of various food categories by cluster.

Cluster 1: Low in protein, fruit and vegetables; Cluster 2: Unhealthy diet (high in cereal foods, processed/highly processed foods & beverages); Cluster 3: Healthy diet (high in fruit & vegetables)

(reward) system and reduce the hypothalamic-pituitary-adrenal stress response, and therefore alleviate symptoms of stress [27-30]. Over consumption of sweets/processed/fast foods (high in carbohydrate, sugar and fat) have been linked to stress through sensory pleasure, distraction and other nutritional or metabolic effects [7,31-32].

Further, the students in the Cluster 1 dietary pattern were 1.7 times more likely to suffer from moderate to severe levels of stress. This dietary group presented low intakes of protein (meat, chicken, fish/seafood, dairy, eggs and meat alternatives) and fruit/vegetables. Previous studies have shown that adequate intakes of fruit and vegetables, dairy and soya products were inversely associated with the prevalence of stress [7,33]. The relationship between fruit and vegetable intake and mental health status may be partially attributed to the high folate content of fruit and vegetables. Folate is responsible for the methylation of homocysteine to methionine and is also involved in the regulation of neurotransmitter metabolism. Therefore, low folate intake may result in high levels of homocysteine, which has been associated with depression, and impaired neurotransmitter metabolism required for functional mental health [34-35]. Thus, the low intakes of these foods might lead to a higher risk of stress and poor mental health status.

Female students were more likely to be stressed than male students, similar to the findings of other studies [3,6]. Married students were also more likely to report experiencing stress, which could be due to time constraints of managing both academic and family tasks. The students enrolled in non-health academic groups were more likely to suffer from stress than those studying in any disciplines of health (OR=1.68 for mild stress, OR=1.51 for moderate to extremely severe stress; both p values<0.05). These results were different from the findings of other Asian studies which revealed a higher prevalence of stress among medical students or prospective medical students [6,8,9].

In addition, having a higher BMI and/or engaging in a lower frequency of exercise were also found to be independently associated with having moderate to severe stress levels. These results are consistent with the findings from previous studies. For example, a positive relationship between psychological stress and weight gain was found in a population-based study among Australian adults [36] and higher levels of perceived stress was found to be associated with lower levels of physical activity [37].

The present study also found that the students who worked more than 20 hours a week (for earning) had higher odds of experiencing moderate to severe levels of stress. A study by Kulm and Cramer [38] indicated that university students' increasing work hours have added stressors of finding sufficient time to devote to academic work and engage in social activities. However, we do not have information on time constraints and thus unable to explore this hypothesis.

The present study has also found that students who lived off-campus/in shared accommodation had higher odds of experiencing moderate to severe levels of stress. On the contrary, a study conducted among students in two Australian universities showed that students who lived alone or in other off-campus accommodation had higher rates of psychological distress compared to students residing in on-campus university accommodation [3]. This study also showed no significant

difference in the incidence of psychological distress between domestic and international students [3], a finding similar to that was observed in the present study.

The current study has demonstrated its strengths of employing innovative cluster analysis to identify dietary patterns among the Australian university students; and using multinomial logistic regression modelling to specify different combinations of dietary and lifestyle risk factors and demographic characteristics to predict different levels of stress. However, this study has some limitations. Firstly, the study utilised purposive sampling thus students who agreed to participate may have been more interested in the study compared with the students who did not participate. Secondly, data were collected in the form of self-reported data, and thus may have been subject to reporting bias. Thirdly, the cross-sectional nature of this study makes it difficult to determine the causal effects of various risk factors and stress in the study population.

Conclusion

This study found that the majority of undergraduate students experienced some level of stress and that both mild and moderate/severe stress levels were associated with socio-demographic characteristics, risky health behaviours and poor dietary patterns. These findings provide useful information for future studies and health promotion programs aiming to reduce stress levels among university students.

Author contribution

PL contributed to the study design, data analysis and interpretation of results, and wrote the first draft manuscript. TP conducted the literature search and contributed in writing. KP was responsible for data collection, data entry and cleaning, and contributed in writing. FA contributed to the study design, writing and critical revision of the manuscript. All authors approved the final version of the manuscript.

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