STRESS AND DIETARY BEHAVIOUR AMONG FIRST YEAR UNIVERSITY STUDENTS IN AUSTRALIA: GENDER DIFFERENCES

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Abstract:

Objective: This study was designed to examine the relationship between stress and food selection patterns by gender among first year undergraduate students studying in an Australian university.

Research Methods & Procedure: A total of 728 (331 males and 397 females) first year students, aged >18 years, attending the Gold Coast Campus of Griffith University participated in this cross sectional study. Data were collected using a self-administered questionnaire consisting of three sections: socio demographic information, stress measures and a 7-day food frequency questionnaire.

Results: Over half (52.9%) of the participants were found to suffer from some level of stress, with relatively more females (57.4%) suffering than males (47.4%). Male students who experienced mild to moderate levels of stress were 2-3 more likely to eat cereal foods (p <0.01), fish/seafood (p <0.001) and protein powder (p <0.05); and also tended to eat more meat alternatives (p <0.05), highly processed foods (p <0.05) and alcohol (p <0.05); than the unstressed male students. However, they were less likely to consume vegetables and fruit (p <0.05) compared with the unstressed males. The trend analysis results indicated significant dose-response patterns in the relationship between stress level and the consumption of cereal food, meat alternatives, vegetables and fruit (negative trend), highly processed food, protein powder, beverages and alcoholic beverages (all p values <0.05). Female students who experienced mild/moderate stress were 2.22 times more likely to eat processed food (p <0.01) than the unstressed females. Females who experienced severe stress were less likely to consume meat alternatives (p <0.05) than the unstressed females. Significant dose-response trends were found in the relationship between stress level and the consumption of meat alternatives, vegetables and fruit (both negative trends), and processed food (all p values <0.01).

Conclusion: These results show a clear difference in food selection patterns between stressed male and female students with stress being a more significant predictor of unhealthy food selection among male students. Further research is needed using a qualitative approach to understand how stress and eating behaviour are related among university students.

Introduction:

For many students, the transition from the high school environment into the university environment is accompanied by emotional and/or psychological distress [1]. The transfer into a new physical and social environment, often accompanied by new relationships, financial demands and expectations may bring with it increased levels of psychological distress [2]. Recent Australian literature reported that the occurrence and complexity of psychological distress among university students is on the rise [2]. More worryingly, the prevalence of psychological distress among Australian university students surpasses that of the same age non-student population and that of the general Australian population [2, 3].

There is substantial evidence that stress can affect an individual's health not only through direct physiological processes but also by changing behaviours which affect health [4, 5]. One such health behaviour is dietary behaviour [5]. Stress has been associated with affecting the amount of food consumed. Some studies have shown that individuals tended to increase consumption of high caloric and high fat snack foods when stressed [4, 5], while other studies reported that individuals ate less of all foods when stressed [6]. Stress has also been associated with the selection of foods consumed [5]. Studies have shown an increase in the preference for carbohydrate rich foods during times of distress [7, 8]. This increase has been partially attributed to the relationship between carbohydrate intake and serotonin brain activity [9]. Serotonin is a neurotransmitter in the central nervous system that has the capacity to alter moods and behaviours including anxiety, depression and anger [10]. Further, the intake of snack type foods, pre-prepared ready-to-eat foods and sweet foods such as chocolate, cakes and ice-cream, was found to increase among students experiencing stress [5, 9-11]; while the Intake of healthy food such as vegetables tended to decrease [4, 5].

Studies have shown that food selection patterns amongst stressed individuals can vary by country of residence [8], dieting status [11] and/or gender [5, 12]. The findings surrounding the relationship between food selection, stress and gender remain inconclusive. For instance, one study that compared food selection between stressed and unstressed males found that stress had no effect on food selection [12], while a similar study reported that stress was associated with an increase in the consumption of red meat, pizza and soda among male participants [13]. Similarly, some studies have reported that although females tended to be more health conscious than men during non- stress periods (i.e. opting for low calorie foods) [14, 15], that females were likely to increase consumption of high sugar, high fat foods and unhealthy snacking; while reducing intakes of healthier foods like vegetables when stressed [15]. The university transition period is crucial for the establishment of future health behaviours [4, 16, 17]. Therefore, a negative association between stress and healthy dietary behaviour would be particularly concerning for young university students.

Overall, the studies that have assessed the relationship between psychological stress and dietary behaviours have either done so using the general population [13], by studying one gender [7, 12] or without taking into account total dietary behavior [5, 16]. To our knowledge, no research in Australia has assessed the relationship between stress and food selection patterns of university students by gender while accounting for various socio demographic factors [15, 18-21]. Thus, this study aims to describe the level of stress among first year students in an Australian university and to assess the relationship between stress and food selection patterns by gender. This study may provide information to help health professionals develop appropriate and holistic interventions for helping young adults cope with stress and simultaneously maintain healthy eating habits.

Subjects and methods:

Study participants:

A cross sectional study design was used to collect data from Undergraduate students studying at the Gold Coast campus of Griffith University, Australia. Griffith University has 5 campuses. The selection of this campus was based on its diverse academic cohort, its large number of international students and because it is the biggest of the 5 campuses. A total of 728 first year students (331 males and 397 females) from four different schools participated in the study. The study was approved by the Griffith University Human Research Ethics Committee.

Sampling:

To be included in this study, students had to be enrolled in a first year course at Griffith University. All students were approached in their lecture halls during weeks 10 to week 13 of the 2nd semester of 2012 and during weeks 10 to week 13 of the 1st semester in 2013. These two periods were selected 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 at the end of the lecture to any interested student. Over the total 8 week data collection period, 800 first year students were approached. Of these students, 728 agreed to participate making the overall response rate of participants 91.0%. Of the 375 male and 425 female students approached, 331 (response rate of 88.3 %) and 397 (response rate of 93.4 %) participated in the study.

Data collection:

The questionnaire was pre tested with the same cohort prior to being finalized. The questionnaire was comprised of three sections: socio-demographic, stress measures, and dietary pattern for selected food items.

Section 1: Socio Demographic: The socio-demographic section gathered information on areas including: 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: Stress among the participants was assessed using the Depression Anxiety Stress Scale (DASS) version 21. The DASS has been validated successfully for different populations and is a popular tool for assessing the severity of the main symptoms for depression, anxiety and stress among researchers in and outside of Australia [22]. This study only used one section of the DASS, the stress scale section. The stress scale section consists of 14 items that assess difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient [23]. The DASS scale uses a 4-point Likert scale of frequency or severity to rate the degree of stress experienced by participants' during the previous week period [22]. The 4-point scale ranges from 0, which means that the participant feels that the item "did not apply to them at all" to 3, whereby the participant feels that the item "applied to them very much, or most of the time"[23]. Individuals' stress scores were calculated through the sum up of all of the scores from the 14 items and through the comparison of those scores to the cut-off scores for normal, moderate and severe stress levels found in the DASS Manual.

Section 3: Dietary Intake: The dietary patterns of the study participants were assessed using the Commonwealth Scientific and Industrial Research Organization (CSIRO) Food Frequency Questionnaire (FFQ). The FFQ selected for this study was chosen based on its

157 repeated validation success for the Australian adult population [24, 25]. Information on the
158 frequency of food intake was assessed based on the students' previous one-week period using
159 an 8-ranged scale. Food frequency intake responses ranged from "never" to "3+ times per
160 day". The frequency of consumption for each food or beverage in the past week was
161 converted into a daily equivalence as follows: not in the past week (0.00 per day), once a
162 week (0.14 per day), 2-3 times a week (0.35 per day), 4-6 times a week (0.70 per day), once
163 daily (1.00 per day), twice daily (2.0 per day) and three or more times daily (3.0 per day).
164 The FFQ was focused on the frequency of selected food items only and information on the
165 portion size was not included. The food categories listed in the FFQ included: cereal foods
166 (breakfast cereal, white and wholemeal bread, rice and pasta); fish and seafood (fresh and
167 canned seafood); meat and chicken (beef, pork and lamb); offal (liver and kidney); dairy and
168 eggs (yogurt, whole fat and skimmed fat milk and cheese varieties); meat alternatives (nuts,
169 legumes and tofu); vegetables (starchy and leafy) and fruit; processed food (fast food, meat
170 pies, sausages and kebab); highly processed food (Jams, bakery sweets, crisps, ice cream and
171 chocolate or muesli bars); protein powder; non-alcoholic beverages (energy drinks, sodas,
172 juices and flavoured milk); warm beverages (tea and coffee); alcoholic beverages (mixers,
173 beers and spirits).

174 *Statistical Analysis:*

175 Univariate analysis comprised of simple frequency distribution of selected variables. The
176 proportion of male and female students who exceeded the specific cut-off scores for various
177 stress levels was calculated. As the distributions of all food categories were positively skewed
178 (majority of the participants had small amount of consumption), a Mann-Whitney U test was
179 performed to compare the difference in the intake of each food category between male and
180 female participants

Finally, associations between stress and dietary behaviours were assessed using logistic regression analysis for male and females separately. Each of the food categories were treated as outcome (dependent) variables with stress treated as the independent variable. All food categories were divided into two groups using median intake cut-offs under each gender group. The independent variable (stress) was categorized into three levels: no stress (treated as the reference category), mild/moderate stress and severe stress (severe and extremely severe were combined). Studies have found that stress is associated with various socio-demographic factors [26, 27]. Therefore, the data were adjusted for potential confounders including marital status, study status, living situation, working hours, frequency of exercise, Body Mass Index (BMI), whether participants were trying to lose weight and smoking status. Age was eliminated in the logistic models due to a relative large proportion (approximately 13%) of missing values for both male and female participants. Results of the regression analyses are presented as odds ratios adjusted for confounding variables. A *p* value for trend was produced in conjunction with the logistic regression analysis to examine significant dose-response trends between the dependent variables (food categories) and the independent variable (stress). A *p* value of 0.05 or less was considered statistically significant. Data was analysed by using Statistical Package for the Social Sciences (SPSS) version 21.0-computer software.

Results:

Of the participants, 45.5% (331) were males and 54.5% (397) were females (Table 1). Mean (SD) age of the participants was 21.5 (2.8) years for males and 21.2 (3.0) years for females. About 73% of all participants were single, only 1.1% were separated/divorced and the rest were married or living with partner. However, a significantly higher proportion of males were single compared with females (81.2% vs 67.6%, $p<0.001$). Over half (54.5%) of the participants were living on their own, with 8.9% living on campus and 45.6% living off

206 campus, and the rest were living with family. A large majority (83.7%) of the participants
207 were domestic students with almost equal numbers among males and females. Forty eight per
208 cent of participants were doing paid part-time work for more than 10 hours per week, while
209 others were full time students or working less than 10 hours per week. Nearly half (49.5%) of
210 the participants reported doing physical exercise >3 days a week, another 31.7% reported
211 doing physical exercise 1-2 times a week and the rest (18.8%) reported either never or rarely
212 doing the exercise. Males tended to exercise more frequently than females (p<0.001). The
213 prevalence rates of overweight (BMI=25-29.9) and obesity (BMI≥30) were 41.3% and 21.4%
214 among male and female participants respectively; whereas only 2.8% of males and 7.7% of
215 females were considered underweight (p<0.001). Less than one quarter of male participants
216 were trying to lose weight, whereas almost half (48.9%) of female participants wanted to lose
217 weight (p<0.001). Among all student participants, about 7% of them were smokers (Table 1).

218 About 53% of all participants were found to suffer from some level of stress, with relatively
219 more females (57.4%) suffering than males (47.4%) (p=0.031). Twelve per cent of all
220 females were suffering from severe stress levels, 30.0% had moderate stress and another
221 15.6% had mild stress. Among the males, only 6.6% were suffering from severe stress levels,
222 25.4% had moderate stress and 15.4% suffered from mild stress (Table 1).

223 Table 2 summarises the differences in consumption of different food categories between male
224 and female participants. Males had significantly higher intakes of cereal foods, meat and
225 chicken, offal (liver/kidney), fish/seafood, dairy and eggs, processed food, protein powder
226 and alcoholic beverages than females (p <0.05). However, females consumed much more
227 meat alternatives, vegetables and fruit compared with males (p <0.001).

228 Logistic regression analysis was used to examine the association between stress and the
229 selection of various food groups by gender while controlling for potential confounding

230 factors (Table 3). The male students who experienced mild to moderate levels of stress were
231 2-3 more likely to eat cereal foods (adjusted OR=2.28, 95% CI: 1.29-4.01), fish/seafood
232 (adjusted OR=3.0, 95% CI: 1.68-5.35) and protein powder (adjusted OR=2.17, 95% CI: 1.21-
233 3.91); and also tended to eat more meat alternatives (adjusted OR=1.76, 95% CI: 1.01-3.05),
234 highly processed foods (adjusted OR=1.79, 95% CI: 1.03-3.10) and alcohol (adjusted
235 OR=1.84, 95% CI: 1.03-3.27); than the unstressed male students. However, they were less
236 likely to consume vegetables and fruits (adjusted OR=0.50, 95% CI: 0.29-0.87) compared
237 with the unstressed male students. Due to a very small proportion (6.6%) of male students
238 reporting severe/extremely severe level of stress (resulting in weak statistical power), no
239 statistical significance was found in testing the likelihood of consumption of various food
240 categories. The trend analysis results indicated significant positive dose-response patterns in
241 the relationship between stress level and the consumption of cereal food, meat alternatives,
242 highly processed food, protein powder, beverages and alcoholic beverages, and negative
243 trend for vegetables and fruit intake (all p values<0.05).

244 Among female students, the mild/moderate stressed group was 2.22 times more likely to eat
245 processed food (95%CI: 1.33-3.71) and the severe stressed group was less likely to consume
246 meat alternatives (adjusted OR=0.41, 95% CI: 0.20-0.86) than the unstressed group.
247 Significant dose-response trends were found in the relationship between stress level and the
248 consumption of meat alternatives, vegetables and fruit (both negative trends), and processed
249 food (all p values<0.01). Due to the large proportion of both male and female participants
250 that had never eaten offal foods (liver and kidney) and the large majority of female
251 participants that had never consumed protein powder as a food supplement (50 and 75
252 quartiles were 0), cut-off points for the intake frequency of these foods could not be
253 determined. Therefore, logistic regression analyses were not performed for offal in the male
254 group or for both offal and protein powder in the female group.

Discussion

The present study provides an insight into the association between stress and food consumption patterns among 1st year undergraduate students of an Australian University. This study revealed three important findings. First, we found that more than half (52.9%) of the students were suffering from some degree of stress with significantly more females suffering than males. Second, both stressed male and female students consumed significantly more of the 'less healthy' foods (high in fat and sugar) compared to the unstressed counterpart. Third, there appears to be a difference in food selection patterns between stressed male and female students, with stress being a more significant predictor of unhealthy food selection among male students.

The overall prevalence of stress among our study population surpasses the prevalence of stress found by similar studies conducted in Malaysia (36%) [28], Turkey (27%) [26] and Hong Kong (43%) [29]. However, the prevalence of stress observed in the present study was consistent with the prevalence of stress found among other university students across Australia [20, 21]; except for one recent study conducted at the University of Queensland (UQ) that found an even higher prevalence of stress (83.9%) among students [19] and one study conducted at The University of Melbourne that found a lower prevalence of stress (31.6%) among international students [37]. The discrepancy in the prevalence of stress reported among students in different countries may, to some extent, be due to the differences in methods used to determine stress. Moreover, some studies reported perceived stress [19], thus making it difficult to compare between studies. Difference in findings may also be attributed to the sampling and data collection methods used by the different studies. For instance, participants in the UQ study were sampled from two universities and data were

collected using both web based questionnaires and face to face interviews [19], whereas this study sampled from one university and collected the data using a self-administered questionnaire. Of the two universities included in their study one had very low response rates, which may have created a response bias [27]. It has been shown that a lack of correction of response bias particularly for web based surveys may result in an over estimation of prevalence of mental disorders [39]. Subsequently, the bias arising from the data collection and sampling methodology used in their study may explain the higher prevalence of stress they observed. Similarly, the discrepancy between the prevalence of stress observed among the students in this study and among the international students involved in the University of Melbourne study may have also been attributed to sampling methods. International students usually suffer from an increased prevalence of stress when compared to domestic students [27]. Thus, with the majority of the students in this study being domestic, it would have been expected to find a higher prevalence of stress among their study cohort. However, our study only sampled first year under graduate students whereas their study sample included both under graduate and postgraduate students. First year under graduate students were specifically selected for this study because they have an increased risk of having poor mental health during their first year of university life (commonly attributed to moving from home for the first time and coping with additional time pressures); and as such are more likely to experience behavioral changes that can have negative health implications [1]. Conversely, as students progress to higher years at university, the prevalence of stress decreases [26, 29]. Therefore, it is possible that the inclusion of postgraduate students in their sample lowered the prevalence of stress reported in their cohort. Another important factor that may have contributed to the differences in the observed prevalence of stress is the socio-cultural characteristics of the study participants. However, it is important to recognize the fact that

studies have shown that the prevalence of psychological distress may vary according to the academic time of the year [19].

This study also found that a significantly higher proportion of female students suffered from stress when compared to male students, a finding similar to that was observed among university students in Hong Kong [29], Turkey [26] and in Australia [19, 27]. Further, examination of the severity of stress found that about 42% of the female and 32% of the male students were found to have moderate to severe state of stress. It is worth noting that ongoing moderate to severe levels of stress are likely to lead to some functional impairment. This may have an adverse effect on their physical and mental health, educational attainment and productivity and overall quality of life [20, 27].

Assessment of the dietary patterns of the participants demonstrated that overall males consumed significantly more 'unhealthy foods' like alcohol and processed foods, while female students ate significantly higher amounts of 'healthy foods' such as fruits and vegetables. The findings of the food selection patterns by gender in this study were very similar to findings from a recent study conducted among German university students [15]. That study found that the female gender was a significant predictor of attitude towards healthy eating [15]. This could explain why the female students in this study consumed significantly more of the 'healthy' food choices such as fruits and vegetables than the male students.

In the present study, the relationship between stress and food selection patterns by gender was examined using logistic regression, where some of the socio-demographic factors known to affect dietary behaviour were adjusted for [26, 27]. This multivariate analysis revealed that although both male and female students were more likely to consume more of the unhealthy foods than their unstressed counterpart, the risk of selecting unhealthy foods during times of

stress was much higher among the male students. Two other studies also found that males ate significantly more unhealthy foods when stressed. One study found that stressed male students ate significantly less fruits and vegetables than the unstressed male students [4]. The other study found that male adults consumed a significantly higher fat diet when stressed [13]. Similarly to our study, these two studies both took into account a series of socio-demographic characteristics that have been shown to be associated with dietary patterns in both genders.

The higher consumption of unhealthy foods during periods of stress has also been reported elsewhere [9, 10, 30]. Different theories have been raised surrounding this phenomenon. Two recent studies have attributed the preference and consumption of unhealthy foods during times of stress to the quick availability of these foods [8, 10]. These studies highlighted that 'healthy' foods (i.e. salads) may take longer to prepare [8]. Consequently, the convenience of 'unhealthy' foods may be prioritized over the nutritional value of food during times of stress [10]. In the present study, the association between stress and unhealthy food selection pattern, especially processed foods, may be related to the issue of convenience of food preparation and shopping. Undergraduate university students are likely to be very time poor during the academic year and thus, time constraint may be a strong determinant of unhealthy food selection among university students. Unfortunately, we are unable to explore this hypothesis with the current data set. Further studies are required to explore the effect of time constraint on food selection among undergraduate university students during these times of stress.

Another possible explanation of unhealthy food selection during stressful periods may be the palatability of 'unhealthy' foods [9]. The high palatability of sweet and fatty foods has been shown to relieve stress through the release of endogenous opioids [30]. One laboratory study suggested that the selection of 'unhealthy' foods during times of distress could be attributed to the high energy density of unhealthy foods. That study explained that the consumption of

352 smaller snack type foods might be preferred to the consumption of healthier meal type foods
353 because they are more easily digested while gut activity is suppressed by sympathetic arousal
354 due to stress [30].

355 In this study, stressed male students ate significantly more carbohydrate foods (cereal food
356 and high processed food) than the unstressed men did. The "serotonin hypotheses" is one
357 possible explanation for this food behaviour [9]. This hypothesis suggests that carbohydrates
358 can alter serotonin status in the brain and thereby improve mood. As such, carbohydrate rich
359 foods may be craved during stressful period when mood is low [30]. Further, males in the
360 mild to moderate stressed category were at higher risk of drinking alcoholic beverages. One
361 study conducted among college students reported that a higher consumption of alcohol drinks
362 was used as a coping strategy during times of stress [31].

363 One surprising finding in males was that mild to moderate stress was found to be positively
364 associated with fish and meat alternatives, while in severely stressed females an inverse
365 relationship was observed for meat alternatives. The findings from the males in this study are
366 somewhat conflicting when compared with a UK study that showed a decrease in meat and
367 fish intake by individuals under stressful conditions [9]. These differences may be partially
368 attributed to the discrepencies in sample size between the UK study and the current study.
369 The sample size in this study was more than three times larger than the sample size in their
370 study. As such, this current study may have had more power to detect this association [38].

371 The multivariate analysis also found that moderately stressed females consumed significantly
372 more processed foods than the unstressed females. A few studies have reported a trend
373 towards 'unhealthy' eating among stressed females [7, 9, 10]. One study found that although
374 80% of their female study participants reported that they typically ate a healthy diet, that only
375 34% of these females ate healthy foods when stressed [7]. Similarly, two other studies

reported that when distressed, female participants appeared to lose control of their eating habits which resulted in their consumption the unhealthy foods that they would usually avoid for health or weight motives [5]. It is important to mention that these studies did not take dieting status into account [5] and/or used perceived stress as their measure of stress [7, 9]. The present study has taken into account potential confounding factors including "trying to lose weight (likely to be on a restrained diet)" and thus our findings reflect the influence of stress alone.

Although both the male and female students selected significantly more of the unhealthy foods when stressed, the foods selected by the stressed male students may have worse future health implications than the foods selected by the stressed female students. The stressed males consumed significantly more alcohol and highly processed foods and less vegetables and fruits than the unstressed males. Alcohol consumption has been found to be causally related to many medical conditions [32] and is the leading global risk factor of death among males aged between 15 and 59 years [33]. Similarly, the increased consumption of highly processed foods and decreased consumption of vegetables and fruits has been associated with increased weight gain and obesity [34], which can consequently lead to future health complications and obesity later on in life [35].

This study has some limitations. The cross sectional nature of this study makes it difficult to determine the causal effects of stress on dietary behaviour in both the male and female participants. This study did not adjust for income/living allowance, which has been associated with both stress and diet [36]. Also, this study did not explore other possible determinants of unhealthy food selection among stressed students. These could have included factors such as time constraints and food preparation knowledge and abilities. Finally, this study did not investigate the relationship between stress and total energy, protein, fat and carbohydrate

intakes. This could have provided more specific information for future interventions and disease risk calculations.

Nevertheless, this study was unique in its approach. This was the first study to examine the association between food selection and stress among first year undergraduate university students in Australia by gender while accounting for dieting status, health factors and other socio-demographic variables. This study found that stress levels were high among first year undergraduate students and that stress was associated with the selection of unhealthy foods. This study also found that stress was a more important predictor of food selection patterns among male students. The development of university programs should be focused on how to provide the knowledge and resources for students, especially for male students, to healthfully cope with stress and thus reduce the potential negative implications of stress on health of this vulnerable group. Further research should use a qualitative approach to understand how other potential factors may be related to stress and eating behaviour among university students in order to develop appropriate interventions.

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Author's contribution: KP was responsible for data collection, data entry and cleaning, and wrote the first draft manuscript. FA conceived the idea for this study, contributed to the study design, writing and critical revision of the manuscript. PL contributed to the study design, data analysis and interpretation of results, and critical revision of the manuscript. JW contributed to the study design, writing and critical revision of the manuscript.

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513 **Table 1**: Socio-demographic characteristics of the study participants by gender.

N 728	**Total**	**Male**		**Female**		
	n (%)	n	%	n	%	P-value*
Age group (Year) (Mean/SD)		21.48 (2.84)		21.23 (2.96)		
18-20	306 (48)	133	45.9	173	49.9	0.315
21+	331 (52)	157	54.1	174	50.1	
Marital status						<0.001***
Single	533 (73.2)	268	81.2	265	67.6	
Separated/Divorced	8 (1.1)	2	0.6	6	1.5	
Married/Partnership	181 (25.1)	60	18.2	121	30.9	
Study status						0.598
Domestic	604 (83.7)	277	84.5	327	83.0	
International	118 (16.3)	51	15.5	67	17.0	
Living situation						0.219
On campus accommodation	64 (8.9)	24	7.3	40	10.1	
off campus accommodation	330 (45.6)	145	44.2	185	46.9	
At home with family	329 (45.5)	159	48.5	170	43.0	
Working hours/week (paid employment)						0.071
0-10	376 (51.9)	184	55.6	192	48.9	
≥11	348 (48.1)	147	44.4	201	51.1	
Exercise (times/week)						<0.001***
Never or rarely	136 (18.8)	46	13.9	90	22.8	
1-2 times/week	230 (31.7)	87	26.4	143	36.2	
≥3 times/week	359 (49.5)	197	59.7	162	41.0	
BMI						<0.001***
0-18.49	39 (5.5)	9	2.8	30	7.7	
18.5-24.99	455 (64.1)	180	55.9	275	70.9	
25-29.99	178 (25.1)	113	35.1	65	16.8	
≥30	38 (5.3)	20	6.2	18	4.6	
Trying to lose weight						<0.001***
Yes	268 (36.8)	74	22.4	194	48.9	
No	460 (63.2)	257	77.6	203	51.1	
Smoking status						0.121
Smoker	50 (6.9)	28	8.5	22	5.5	
Non-smoker	678 (93.1)	303	91.5	375	94.5	
Stress level						0.031*
Normal	343 (47.1)	174	52.6	169	42.6	
Mild	113 (15.5)	51	15.4	62	15.6	
Moderate	203 (27.9)	84	25.4	119	30.0	
Severe	56 (7.7)	17	5.1	39	9.8	
Very severe	13 (1.8)	5	1.5	8	2.0	

514 Chi-square tests were performed for gender comparisons.

515 *p<0.05; **p<0.01; ***p<0.001

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517 **Table 2:** Differences in intake of various food categories between male and female students

	Male		**Female**				
	Median	Range	Median	Range	Mann Whitney U	Z - Value	P- Value*
Cereal foods	2.00	0-16	1.63	0-10.26	50836.5	-5.26	<0.001***
Meat and Chicken	0.98	0-6	0.77	0-6	46469.5	-6.85	<0.001***
Offal	0	0-1	0	0-0.77	63036	-2.15	0.031*
Fish and Seafood	0.49	0-6	0.42	0-3.56	57175	-3.040	0.002**
Dairy and Eggs	1.82	0-10.19	1.68	0-9.14	58588.5	-2.52	0.012*
Meat Alternatives	0.28	0-3.77	0.56	0-5.28	49923.5	-5.63	<0.001***
Vegetables and Fruit	1.47	0-9	1.75	0-8	53551.5	-4.30	<0.001***
Processed food	0.56	0-3.91	0.28	0-3.29	44346.5	-7.63	<0.001***
Highly processed food	1.71	0-9.28	1.61	0-16.56	61549	- 1.34	0.182
Protein powder	0.14	0-3	0	0-2	46986.5	-7.55	<0.001***
Beverages	1.33	0-11.14	1.33	0-6.91	62253.5	-1.17	0.244
Alcoholic beverages	0.28	0-6.77	0.14	0-3.49	54952	-3.89	<0.001***

518 Mann-Whitney tests were performed for gender comparisons.

519 *p<0.05; **p<0.01; ***p<0.001

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Table 3: Odds ratios for various food categories consumption associated with stress level among Griffith University students by gender.

	Male adjusted OR (95%CI)				Female adjusted OR (95%CI)			
Stress level / **Food category**	Normal	Mild/Moderate	Severe	P for trend	Normal	Mild/Moderate	Severe	P for trend
Cereal foods	1.00	2.28 (1.29-4.01)**	2.65 (0.91-7.70)	<0.001***	1.00	1.39 (0.86-2.27)	1.13 (0.55-2.32)	0.235
Meat and Chicken	1.00	0.65 (0.38-1.11)	1.07 (0.40-2.84)	0.134	1.00	1.18 (0.74-1.90)	0.76 (0.38-1.54)	0.633
Fish and Seafood	1.00	3.00 (1.68-5.35)***	0.64 (0.23-1.82)	0.064	1.00	1.05 (0.66-1.68)	1.22 (0.61-2.44)	0.562
Dairy and Eggs	1.00	1.52 (0.88-2.61)	0.95 (0.36-2.48)	0.417	1.00	0.94 (0.58-1.51)	0.97 (0.48-1.96)	0.886
Meat Alternatives	1.00	1.76 (1.01-3.05)*	1.92 (0.68-5.38)	0.016*	1.00	0.97 (0.60-1.57)	0.41 (0.20-0.86)*	0.009**
Vegetables and Fruit	1.00	0.50 (0.29-0.87)*	0.35 (0.63-1.68)	0.029*	1.00	0.78 (0.48-1.27)	0.48 (0.23-1.01)	0.002**
Processed food	1.00	1.42 (0.82-2.47)	1.32 (0.48-3.64)	0.072	1.00	2.22 (1.33-3.71)**	1.95 (0.92-4.12)	<0.001***
Highly processed food	1.00	1.79 (1.03-3.10)*	1.69 (0.62-4.60)	0.044*	1.00	1.29 (0.80-2.10)	1.17 (0.57-2.38)	0.163
Protein powder	1.00	2.17 (1.21-3.91)*	2.64 (0.88-7.89)	0.042*	1.00			
Beverages	1.00	1.41 (0.83-2.39)	2.35 (0.86-6.38)	0.037*	1.00	0.92 (0.57-1.50)	1.94 (0.92-4.12)	0.159
Alcoholic beverages	1.00	1.84 (1.03-3.27)*	1.78 (0.64-4.96)	0.007**	1.00	1.12 (0.68-1.83)	0.84 (0.40-1.77)	0.776

The data were adjusted for marital status, academic group, study status, living situation, working hours, frequency of exercise, BMI, trying to lose weight and smoking status.

*p<0.05; **p<0.01; ***p<0.001