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Differences in Daily Food Intake and Body Mass Index between Stressed and Unstressed University Students

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Abstract

Stress adversely affects health through direct biological and indirect behavioural changes, including in young adults. This cross-sectional study aimed to examine the variation between body mass index (BMI), and daily food, energy and nutrient intakes among Universiti Sultan Zainal Abidin students according to their stress levels. A total of 221 eligible students aged 18–29 years were recruited. Data were collected using a validated self-administered Malay-language questionnaire as follows: sociodemographic, Depression Anxiety Stress Scales 21 questionnaire, and semi-quantitative Food Frequency Questionnaire. Weight and height were also measured using standard procedures. Data were analysed using independent samples t-test and Mann-Whitney U test. Overall, 38.9% of the students experienced stress; 26.2% and 17.6% were overweight and obese, respectively. The average daily energy intake (TEI) for male and female students was 2,992±1,063 kcal and 2,352±1,002 kcal, respectively. Approximately 62.9% and 87.8% of the students met their recommended daily intake of carbohydrates and protein, respectively. The majority of respondents did not achieve 25–30% of TEI for fat (69.6%) and had excess sugar (77.4%) and sodium (65.6%). The top 10 foods consumed daily were rice (96.8%), chicken (68.3%), table sugar (57.0%), green leafy vegetables (44.3%), candy/chocolate (29.9%), hen eggs (28.5%), tea (18.6%), marine fish (18.1%), apple (16.3%), and condensed milk (12.7%). Stressed students had significantly higher BMI (24.3±6.3 kg/m^2, p=0.021) compared to their peers (22.6±4.7 kg/m^2). Stressed students consumed more pizza (Z=2.16; p=0.031), sausage/hotdog/frankfurter (Z=2.35; p=0.019), chicken/meat balls (Z=2.10; p=0.035), cake (Z=2.95; p=0.003), peanut butter (Z=2.37; p=0.018), and bean sprouts (Z=2.31; p=0.021) than their peers. However, a comparison among stressed and unstressed students revealed no significant differences in energy, carbohydrates, protein, fat, sodium, and sugar intake. This study shows that stressed students had a higher tendency to consume energy-dense food (i.e. fast foods, peanut butter and cakes) compared with unstressed students. A more detailed study is warranted to determine the personal dietary behaviours of stress eaters.

Keywords

Stress, Body Mass Index, Daily Food Intake, UniSZA Students, Terengganu

Introduction

University life is a time when many young people learn independently while balancing academics and other activities. While pursuing better education and employment opportunities, it can be a stressful time for many students [1]. High expectations for academic performance have created a very stressful environment,

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which, if untreated, can have adverse effects on their physical and mental health [2]. A growing body of research shows that stress is one of the most common mental illnesses among university students across countries such as China (22.9%) [3], Korea (47.0%) [4], Jordan (58.7%) [5], Saudi Arabia (59.0%) [6], Malaysia (33.3–87.0%) [7-11], Pakistan (84.4%) [12], Oman (96.9%) [13].

Stress scores were shown to be significantly higher among older age (20 years and above), female and Malays students, and those from low- or high-income families [1]. Hence, multiple adjustments to university life are required. However, adjustment difficulties can be extremely stressful and are often reflected in an individual's food choices and eating behaviours [14]. Studies revealed that under stress, college students exhibited two opposite behaviours, namely overeating (eating certain types of food more frequently) and undereating (eating less, e.g., skipping meals) [4,15]. High-stress individuals showed less healthy dietary behaviours than the low-stress individuals, such as more sugary snacks, carbohydrate-rich foods, fast food, and ready-to-eat foods [16]. People who are stressed tend to eat sugary foods and drink alcohol to feel better [17]. This phenomenon is known as "comfort eating – eating palatable food that provides a sense of comfort or well-being', and it is a pathologic coping mechanism for chronic stress [18]. However, little is known about whether an unhealthy comfort food high in calories, fat, or sugar relieves stress [19].

Comfort eating unhealthy foods may temporarily improve mood or relieve stress, but in the long run, frequent eating of high-calorie comfort foods during stress could lead to weight gain and various health issues [15,20-22]. A recent study in China reported that perceived academic stress was significantly associated with a greater risk of being overweight/obese among all college students, males, undergraduates, and students from subordinate universities [3]. Furthermore, Finch and colleagues (2019) [19] conducted an experimental study investigating psychophysiological stress reactivity and recovery after eating unhealthy and healthy comfort foods in 150 healthy undergraduate females and found that women will not be sacrificing any of the stress-reducing benefits of eating any comfort food, but it can substantially improve quality diet while avoiding potential downsides of unhealthy comfort eating, such as obesity.

Numerous studies have been conducted on the link between stress with excessive consumption of unhealthy foods and body mass index [4,23-24]. However, such studies in Malaysia are limited, especially among undergraduate students on the east coast of Malaysia, including Terengganu. Therefore, this study examined whether body mass index (BMI) and daily food, energy and nutrient intake of undergraduate students at Universiti Sultan Zainal Abidin (UniSZA) differ according to their stress levels. It is anticipated that the findings of this study could bridge the knowledge gap in the existing literature by contributing to a better understanding of the relationships between stress, dietary behaviour and nutritional status of Malaysian students.

Methods

Study design and location

This was a cross-sectional study conducted among undergraduate students at the Universiti Sultan Zainal Abidin (UniSZA), Kuala Nerus, Terengganu in 2022.

Ethical consideration

Ethical approval was obtained from the UniSZA Human Research and Ethics Committee (UHREC, UniSZA 800-1/1/2). Prior to data collection, researchers distributed the information sheets (poster) to all undergraduate students and contacted class representatives to arrange a date for a face-to-face survey. Undergraduates willing to participate were informed verbally during the survey, and screened based on inclusion and exclusion criteria. Initial consents were also obtained from the respondents.

Study subjects

A total of 221 undergraduate students at UniSZA (Gong Badak Campus) in Terengganu aged 18–29 years without any health disabilities were recruited into this study. The UniSZA is a public university in the state of Terengganu, located on the east coast of Peninsular Malaysia. There are three campuses, namely the Medical Campus in the Kuala Terengganu district, the Gong Badak Campus in the Kuala Nerus district, and the Besut Campus in the Besut district of Terengganu.

Measurement

A set of self-administered questionnaires in Malay language was used to collect the data.

Socio-demographic characteristics

Data on socio-demographic characteristics, including age, gender, ethnicity, years of degree education, and household income were collected.

Anthropometric measurements

Height and body weight were measured using calibrated SECA stadiometer (Vogel and Halke & Co., Hamburg, Germany) and TANITA weighing scales (Tanita Corporation, Tokyo, Japan), respectively based on standard procedures [25]. The average height and weight were then used to calculate body mass index (BMI), which was body weight (kg)/ squared height (m^2). BMI was categorized according to the Asia-Pacific guidelines [26]. Underweight, overweight and obesity were defined as BMI <18.5 kg/m^2, 23–24.9 kg/m^2, and ≥25 kg/m^2, respectively.

Stress

Stress in this study was assessed using the stress subscale (DASS-21-S) in Depression Anxiety Stress Scale-21 (DASS-21) questionnaire [27]. There are seven items in this subscale, with the rating scale from "0=did not apply to me at all" to "3=applied to me very much or most of the time". Scores for the stress subscale were calculated by summing the scores for the seven items of stress subscale and multiplying them by 2 to match the original 42-question version of the DASS-42. This because the DASS-21 is the short form of the DASS-42. The total score of stress subscale ranged from 0–42, in which a higher score indicated higher stress. The stress scores were then categorised; respondents who scored below 14 were considered "normal", while those who scored above 14 were considered "stress: 15–18 as mild, 19–25 as moderate, 26–33 as severe and 34+ as extremely severe symptoms". Additionally, before data collection, a pre-test on the seven items of the stress subscale was conducted among 34 respondents, and a reliability test was employed to measure the internal consistency of these seven items (Cronbach's alpha=0.75).

Energy, nutrient and daily food intake

The daily food intake was assessed using a semi-quantitative food frequency questionnaire (FFQ). This FFQ is a tool to measure the frequency of foods and beverages consumed in the past one month, and it composed of 126 food items classified into 13 food groups, namely 1) cereals and cereal-based products; 2) meat and meat products; 3) fish and seafood; 4) eggs; 5) legumes and legume products; 6) milk, non-milk and dairy products; 7) vegetables; 8) fruits; 9) beverages; 10) alcoholic drinks; 11) confectioneries; 12) bread spread and 13) flavours. Respondents were asked to recall the foods that they consumed, how often, and how much they had eaten in the past month. The frequency of food consumption was divided into four open-frequency categories of response to facilitate the estimation by the respondents: times per day, week, month, and never. The frequency of consumption was then converted from per month to per day according to the conversion factor by Norimah et al. (2008) [28]. The formula of food consumed (per day) was the frequency of food intake x conversion factor. The daily frequency was then multiplied by the amount consumed (g or ml). The dietary data were analysed using the Nutritionist Pro™ Software version 2.5 (First Databank, USA, 2005) to determine the energy, macronutrient, sugar and sodium intake of respondents. The food databases used in the analysis include the Malaysian Food Composition Tables, the Singapore Food

Database and the United States Department of Agriculture (USDA) nutrient database. Dietary adequacy was then assessed by comparing the intake of the respondents to the Malaysian Recommended Nutrient Intakes (RNIs) [29].

Statistical analysis

Data were analysed using IBM SPSS Statistics 26.0 for Windows (IBM Corporation, New York, USA). All variables were tested for normality. All variables are presented as mean and standard deviation for normally distributed continuous variables (age, years of degree education, height, body weight, body mass index, stress score, energy and nutrient intakes), median and interquartile range (IQR) for non-normally distributed continuous variables (daily food intake), and frequency and percentage for categorical variables (gender, ethnicity, household income, BMI category, and stress levels). Due to small sample size for several stress levels, five stress levels were further collapsed into two categories as "unstressed or normal group: individuals with stress scores ≤ 14" and "stressed group: individuals with mild (15–18), moderate (19–25), severe (26–33) and extremely severe symptoms (34+)". Data were then analysed using independent samples t-test for normally distributed variables and Mann-Whitney U test for non-normally distributed variables to determine the difference in BMI, energy, nutrient and daily food intake between unstressed and stressed groups. In the independent samples Mann Whitney U test, scores of continuous variables (daily food intake) were converted into mean rank across two groups of unstressed and stressed. Statistical significance was set at $p<0.05$.

Results

Demographic and socioeconomic characteristics

A total of 221 respondents aged 18–29 years participated in this study; most were female (58%), Malay (91%), single (100%), and from the bottom 40 families (<RM 4,850.00) (59%) (Table 1). The average years of their degree education were 1.9±1.1.

Stress level

The average stress score among the respondents in this study was 11.4±7.3 (Table 1). The majority of respondents (61.1%) reported normal stress, while 38.9% reported stress in the past month. Of the 86 respondents who were classified as under stress, 26.2% reported mild stress, 8.6% were moderate stress, and 4.1% were severe stress. Moreover, more females (46.1%) experienced stress compared to males (28.0%).

Body mass index

The average body weight and height of males and females were 69.0±18.2 kg and 53.3±12.5 kg, respectively, and 167.8±6.6 cm and 154.2±5.5 cm, respectively. The average body mass index (BMI) for male and female respondents was 24.5±6.1 kg/m^2 and 22.4±4.8 kg/m^2 (Table 2). Most respondents were underweight (16.7%), 26.2% were overweight and 17.6% were obese. More females (21.1%) in this study were underweight than males (10.8%) while more males were overweight (26.9% vs. 25.8%) and obese (23.7% vs. 13.3%) than females.

Energy, nutrient and daily food intakes

The average energy intake (TEI) of respondents was 2,621±1,073 kcal/day; male and female respondents consumed 2,992±1,063 kcal/day and 2,352±1,002 kcal/day, respectively (Table 2). Approximately 62.9% and 87.8% of the respondents met the recommended daily intake of carbohydrates (50–65% of TEI) and protein (10–20% of TEI), respectively. However, most respondents did not achieve 25–30% of TEI from fat (69.6%) and had excess sugar (≥10% of TEI) (77.4%). The majority of respondents (65.6%) also had high sodium intake (>2,000 mg/day). Figure 1 shows the top 10 foods consumed daily. Almost all respondents (96.8%) consumed rice every day, followed by chicken (68.3%), table sugar (57.0%), green leafy vegetables

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(44.3%), candy/chocolate (29.9%), hen eggs (28.5%), tea (18.6%), marine fish (18.1%), apples (16.3%), and condensed milk (12.7%) (Figure 1).

Differences in BMI, energy and nutrient intake, and daily food intake between unstressed and stressed groups

The independent samples *t*-test revealed significantly higher BMI (24.3±6.3 kg/m^2 vs. 22.6±4.7 kg/m^2, p=0.021) among stressed students compared to their peers (Table 3). Additionally, independent samples Mann Whitney U test showed that stressed students consumed more pizza (Z=2.2; p=0.031), sausage/hotdog/frankfurter (Z=2.4; p=0.019), chicken/meatballs (Z=2.1; p=0.035), cake (Z=3.0; p=0.003), peanut butter (Z=2.4; p=0.018), and bean sprouts (Z=2.3; p=0.021) than their peers (Figure 2). However, a comparison among stressed and unstressed students revealed no significant differences in energy, carbohydrates, protein, fat, sodium, and sugar intake (Table 3).

Table 1: Demographic and socioeconomic characteristics and stress level of respondents (*n*=221)

Variables	*n* (%)	*Mean±SD*
Demographic and socioeconomic characteristics		
Gender		
Male	93 (42.1)	
Female	128 (57.9)	
Age (year)		20.7±1.4
Ethnicity		
Malay	201 (91.0)	
Others	20 (9.0)	
Years of degree education		1.9±1.1
Household income		
Bottom 40 (<RM 4,850.00)	131 (59.3)	
Middle 40 (RM 4,850.00–10,959.99)	74 (33.5)	
Top 20 (≥RM 10,960.00)	16 (7.2)	
Stress		11.4±7.3
Normal (0–14)	135 (61.1)	
Mild stress (15–18)	58 (26.2)	
Moderate stress (19–25)	19 (8.6)	
Severe stress (26–33)	9 (4.1)	

Table 2: Body mass index, and energy and nutrient intake of respondents (*n*=221)

Variables	*n* (%)	*Mean±SD*
Body Mass Index (kg/m^2)		23.3±5.4
Underweight (<18.5)	37 (16.7)	
Normal (18.5–22.9)	87 (39.4)	
Overweight (23.0–27.4)	58 (26.2)	
Obesity (≥27.5)	39 (17.6)	
Energy intake (kcal/day)		2,621±1,073
Energy intake:BMR ratio		
Under-reporting (<1.35)	45 (20.4)	
Normal (1.35–2.39)	112 (50.7)	
Over-reporting (≥2.40)	64 (29.0)	
Nutrient intake		
Carbohydrate intake (g/day)		341.9±153.2
Carbohydrate intake (% of TEI)		54.9±9.4
<50	59 (26.7)	
50–65	139 (62.9)	
>65	23 (10.4)	
Protein intake (g/day)		102.3±47.4
Protein intake (% of TEI)		16.4±3.0

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Variables	*n* (%)	*Mean±SD*
<10	4 (1.8)	
10–20	194 (87.8)	
>20	23 (10.4)	
Fat intake (g/day)		79.0±42.6
Fat intake (% of TEI)		27.8±7.3
<25	77 (34.8)	
25–30	67 (30.3)	
>30	77 (34.8)	
Sugar intake (g/day)		107.6±68.1
Sugar intake (% of TEI)		
<10	50 (22.6)	
≥10	171 (77.4)	
Sodium intake (mg/day)		2,942.5±1,867.8
≤2,000	76 (34.4)	
>2,000	145 (65.6)	

Energy intake: BMR ratio: Ratio of energy intake to basal metabolic rate; % of TEI: Percentage of total energy intake

Table 3: Differences in BMI, energy and nutrient intake, and daily food intake between unstressed and stressed groups

Variables	Unstressed Group (*n*=135)	Stressed Group (*n*=86)	*t*-value	*p*-value
Body mass index	22.6±4.7	24.3±6.3	-2.3	0.021
Energy intake (kcal/day)	2,663±1,039	2,556±1,127	0.7	0.469
Carbohydrate intake (g/day)	350.4±147.5	328.6±161.7	1.0	0.304
Carbohydrate intake (% of TEI)	55.6±9.3	53.7±9.5	1.5	0.139
Protein intake (g/day)	103.1±45.2	101.2±51.0	0.3	0.767
Protein intake (% of TEI)	16.3±3.0	16.6±3.0	-0.8	0.442
Fat intake (g/day)	79.3±44.2	78.5±40.2	0.1	0.894
Fat intake (% of TEI)	27.2±7.3	28.8±7.2	-1.6	0.120
Sugar intake (g/day)	106.7±64.2	109.0±74.2	-0.6	0.549
Sodium intake (mg/day)	2,882.3±1,909.2	3,037.2±1963.3	-0.2	0.814

% of TEI: Percentage of total energy intake

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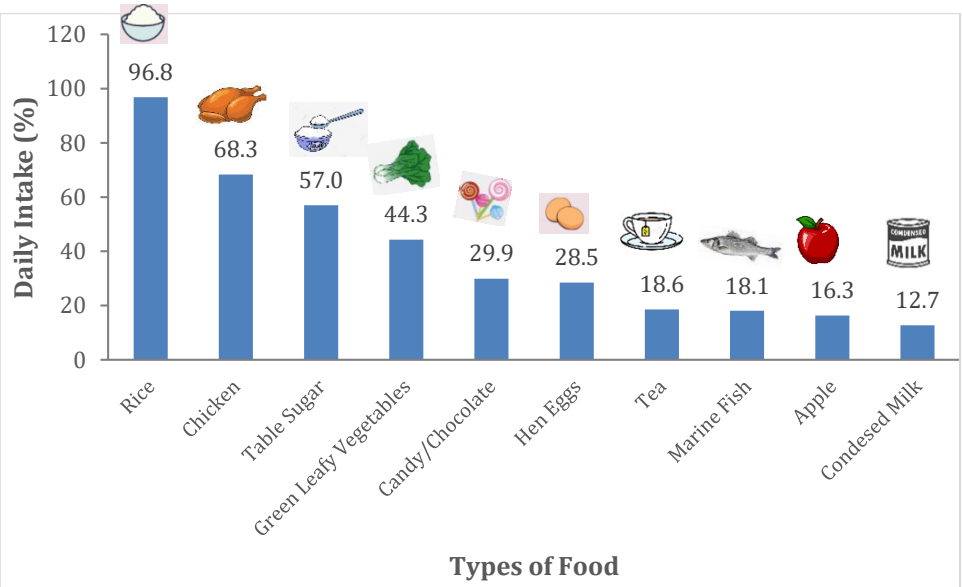

Figure 1: Top 10 food consumed daily

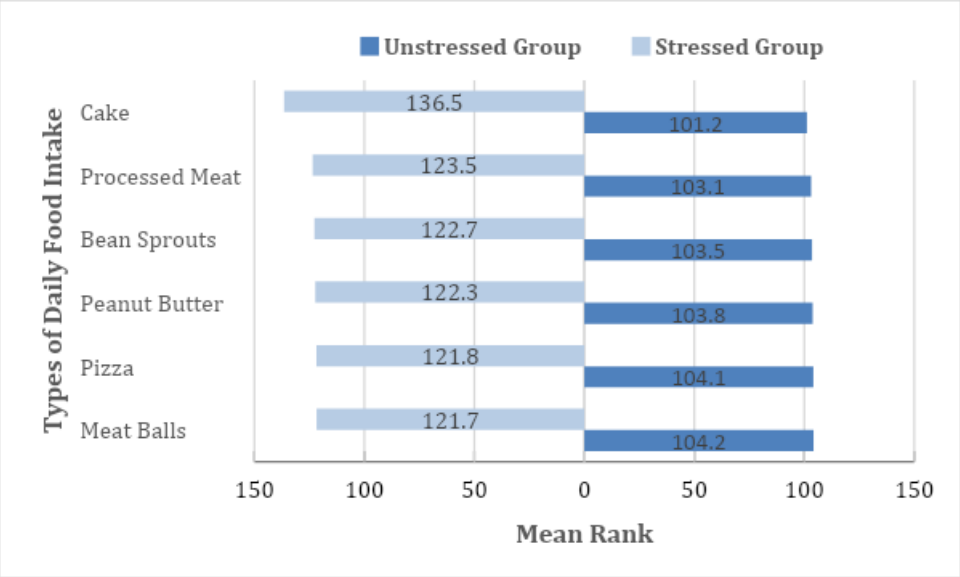

Figure 2: Differences in daily food intake between unstressed and stressed groups

Discussion

Stress is a common mental illness experienced by undergraduate students worldwide [3-13]. In the present study, stress was prevalent among undergraduates (38.9%) in public universities, including UniSZA in the state of Terengganu, Malaysia. This prevalence is higher than that reported in two studies from public universities in Selangor (37.3%) and Sabah (33.3%) [10-11]. However, the stress rate in this study was lower than that reported in several local studies (40.0–87.0%) [7-9]. The high prevalence of stress highlights an important issue concerning the mental health and well-being of university students. Stress levels varied across the studies; likely due to several reasons, including different backgrounds of the target subjects, different study periods or points in time at which data were collected (i.e., before, during or after the COVID-19 pandemic), courses of study (medical, science or arts students), and different tools for assessing stress.

This study showed a high prevalence of overweight (26.2%) and obesity (17.6%) among undergraduate students. These prevalence rates were nearly similar to those reported in the National Health Morbidity Survey (NHMS) 2019, in that 17.6–28.3% and 21.6–29.9% of Malaysian adults aged 18–29 years were overweight and obese, respectively [30]. A cross-sectional study by Mohd Tahir et al. (2021) [31] also reported a similar prevalence of overweight (26.3%) but a lower prevalence of obesity (8.5%) among students at Universiti Teknologi Mara (UiTM) Cawangan Kelantan. Furthermore, the present study indicated that stressed students had a significantly higher BMI (24.3±6.3 kg/m^2) than unstressed students (22.6±4.7 kg/m^2), with an average BMI in the overweight range (p=0.021). A similar study was observed in the United States [32], in which chronic stressors were significantly associated with higher likelihoods of being obese, greater waist circumference and percentage of body fat. One possible reason is that individuals with a higher BMI were more likely to eat energy-dense foods such as fried foods, hamburgers, and sugary drinks due to their biological response to stress [24]. Individuals who are overweight and obese often experience emotional stress, which may promote emotional eating [33]. A recent study of young Italians aged 25–35 years showed that difficulty regulating emotions was associated with higher levels of psychological distress and emotional eating, which in turn was related to greater BMI [34].

In the present study, rice and chicken were the top two foods most students consumed daily; nevertheless, less than half of the students consumed fruits, vegetables, and fish daily, and a fairly high proportion of students reported daily consumption of high-calorie and high-sugar foods such as table sugar (57.0%) and candy/chocolate (29.9%). For nutrient intake, most of the undergraduate students in this study did not meet the recommended intake for fat (69.6%), sugar (77.4%), and sodium (65.6%). About 34.8% of undergraduate students had <25% TEI from fat, and 34.8% had excessive fat intake (>30% TEI). These intakes imply unhealthy dietary habits among undergraduate students. The findings of this study echo those of several local studies conducted among university students [31,35,36]. Mohd Tahir et al. (2021) [31] indicated that among the students in UiTM Cawangan Kelantan, only 38.1% of consumed vegetables 3–5 times a week, 63.6% rarely consumed fruits, and 49.2% consumed fried foods every day. In a study of four European countries (Germany, Denmark, Poland, and Bulgaria), Bulgarian students reported eating "less healthy" foods most often, such as sweets, cakes, snacks, and fast foods [23].

Interestingly, significant differences in daily protein source consumption among the students in UniSZA compared with the findings from the Malaysian Adult Nutrition Survey (MANS) 2014. The top ten food consumed by Malaysian adults were white rice (89.8%), sugar (55.9%), green leafy vegetables (43.2%), marine fish (29.4%), chillies (24.2%), condensed milk/creamer (23.5%), biscuits (13.8%), condiment (14.6%) and hen eggs (14.2%) [37]. In this study, most (68.3%) students ate chicken every day. Meanwhile, it is reported that a higher proportion of students consumed hen eggs daily (28.5%) and a lower proportion of students consumed marine fish daily (18.1%). These differences may reflect that chicken and hen eggs are the main source of protein for UniSZA students, possibly because chicken and hen eggs are more accessible and affordable than other animal protein sources.

Consistent with previous studies [4,6,16,23,24], this study revealed that stressed students tend to consume energy-dense foods such as fast food (i.e., pizza, sausage/hotdog/frankfurter, chicken/meatballs), peanut butter and cake compared with unstressed students. Similarly in Korea, college students with high levels of perceived stress showed increased unhealthy dietary behaviours, e.g. ready-prepared meal consumption [4]. Consumption of energy-dense foods among university students to relieve stress may be because of their palatability, affordability, and convenience [38]. Additionally, we found that there are at least five fast food restaurants near the UniSZA campus (within 10 km), with delivery or takeaway services. This is also supported by a systematic review by Li et al. (2022) [39] that the taste of food was paramount for a student's food choices, followed by the availability and price of food. Students sometimes view unhealthy foods as healthy options, especially for those who are vulnerable to living arrangements and socioeconomic status.

Notably, more than half of the students in this study were from poor families (bottom 40). However, a comparison among stressed and unstressed students revealed no significant differences in energy, carbohydrates, protein, fat, sodium, and sugar intake. A study of private university students by Cheng and Kamil (2020) [9] found mixed results in the stressed group having significantly lower energy, fat (including, saturated fat, mono and polyunsaturated fatty acids intake) and calcium than the non-stressed group. The discrepancy in the findings may be due to misreporting of dietary intake affecting estimated energy and nutrient intakes. In this study, 20.4% of respondents underestimated their energy intake and 29.0% overestimated their energy intake.

The findings of this study can provide a useful reference for the government, university authorities and other relevant stakeholders in planning and implementing intramural initiatives to address poor psychological, dietary habits and nutritional status among university students. Early stress detection and management can help and support university students in making positive changes to their nutritional habits and overall health. However, there are several limitations to be improved for future research. First, as this is a cross-sectional study, it may not be possible to determine the causal effect of stress on dietary habits and nutritional status. Second, subject recruitment was based voluntarily and was aimed at undergraduate students from a single university in Malaysia, which may not be representative of all university students in Malaysia. In addition, there was a tendency for dietary recall bias as the frequency and amount of food consumed were based on respondents' recall and honest reporting, even though our data collection was conducted by trained researchers to reduce the under- or over-reporting. Lastly, the present study did not examine the influence of other variables such as region of residence, household income, availability and accessibility of food, nutrition and health knowledge of respondents on the association between stress with dietary habits and BMI.

Conclusions

Overweight and obesity are prevalent among undergraduate students at Universiti Sultan Zainal Abidin (UniSZA), especially those who are feeling stressed. This study also highlights poor dietary habits among these students. In particular, those who were stressed had a higher tendency to consume energy-dense foods (i.e., fast foods, peanut butter, and cake), which may be considered comfort foods. These undergraduate students' worrisome eating habits and nutritional status is a multifaceted and far-reaching issue. More detailed studies are necessary to determine the personal dietary habits of stress eaters by recognising influencing factors and implementing targeted interventions. With this, we can pave the way for university students to have healthier and more successful academic journeys.

List of abbreviations

BMI – Body mass index
BMR – Basal metabolic rate
COVID-19 – Coronavirus disease
DASS-21 – Depression Anxiety Stress Scale-21
FFQ – Food frequency questionnaire
MANS – Malaysian Adult Nutrition Survey
NHMS – National Health and Morbidity Survey
TEI – Total energy intake
UHREC – University Human Research and Ethics Committee
UniSZA – Universiti Sultan Zainal Abidin
UiTM – Universiti Teknologi Mara

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Conflict of interest disclosure
None to declare

Authors' contributions
All authors substantially contributed to the study and the manuscript. HNA participated in study design, data collection, data analysis and interpretation and manuscript preparation; AMMJ participated in study conceptualization, study design, read and approved the manuscript; WCY participated in data analysis and interpretation, manuscript preparation and finalization.

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