

**ULTRA-PROCESSED FOOD CONSUMPTION AND
ITS RELATIONSHIP WITH MENTAL HEALTH
STATUS AMONG UNDERGRADUATE STUDENTS
IN HEALTH CAMPUS UNIVERSITI SAINS
MALAYSIA**

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UNIVERSITI SAINS MALAYSIA

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by

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**Dissertation submitted in partial fulfilment
of the requirements for the degree of
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TABLE OF CONTENTS

DECLARATION	ii
CERTIFICATE.....	iii
ACKNOWLEDGEMENT.....	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATIONS	x
ABSTRAK	xi
ABSTRACT.....	xiii
CHAPTER 1 INTRODUCTION	15
1.1 Background of the study	15
1.2 Statement of the problem	17
1.3 Significance of the study	19
1.4 Research questions	19
1.5 Research objectives.....	20
1.5.1 General objective	20
1.5.2 Specific objectives	20
1.6 Study hypotheses.....	20
CHAPTER 2 LITERATURE REVIEW	21
2.1 Ultra-processed food (UPF)	21
2.1.1 Definition of UPF	21
2.1.2 Characteristics of Ultra-processed food.....	21
2.1.3 Common types of UPF among university students	22
2.1.4 Prevalence of UPF consumption	23
2.1.5 Factors influencing UPF consumption	25

2.1.5(a)	Socio-demographic factors	25
2.1.5(b)	Lifestyles factors	26
2.1.5(c)	Academic and environmental factors	27
2.2	Mental health	28
2.2.1	Definition of mental health	28
2.2.2	Types of mental health problems	28
2.2.2(a)	Depression	28
2.2.2(b)	Anxiety	29
2.2.2(c)	Stress	29
2.2.3	Mental health issues among university students	29
2.2.4	Prevalence of mental health problems	30
2.2.5	Factors influencing mental health problems	33
2.2.5(a)	Academic stress	33
2.2.5(b)	Dietary habits and nutrition	34
2.3	Association between UPF consumption and mental health	35
2.4	Conceptual framework	38
CHAPTER 3 METHODOLOGY		40
3.1	Study design	40
3.2	Study location	40
3.3	Target population	40
3.4	Selection criteria	40
3.5	Sampling method	41
3.6	Sample size calculation	41
3.6.1	Study instruments	44
3.7	Operational definition	46
3.8	Data collection	48
3.9	Data analysis	49

3.10	Ethical clearance	50
3.10.1	Subject vulnerability	50
3.10.2	Privacy and Confidentiality	51
3.10.3	Community Sensitivities and Benefits.....	51
3.10.4	Declaration of Conflict of Interest	52
CHAPTER 4	RESULTS.....	53
4.1	Socio-demographic characteristics of participants	53
4.2	Ultra-processed food consumption among undergraduate students	55
4.3	Mental health status among undergraduate students.....	56
4.4	Relationship between UPF consumption and mental health status.....	57
CHAPTER 5	DISCUSSION.....	60
5.1	Discussion	60
5.2	UPF consumption.....	61
5.3	Mental health status	64
5.4	Relationship between UPF and mental health	67
5.5	Strengths and limitations of the study	70
CHAPTER 6	CONCLUSION AND FUTURE RECOMMENDATIONS.....	72
6.1	Conclusion	72
6.2	Recommendations.....	72
REFERENCES.....		73
APPENDICES		
Appendix A:	SOCIO-DEMOGRAPHIC QUESTIONNAIRE	
Appendix B:	24-HOUR DIETARY RECALL	
Appendix C:	DEPRESSION, ANXIETY, AND STRESS SCORES (DASS-21)	
Appendix D:	PERMISSION TO USE DASS-21	
Appendix E:	PARTICIPANT INFORMATION CONSENT	
Appendix F:	JEPER APPROVAL LETTER	

LIST OF TABLES

	Page
Table 2.1 Prevalence of mental health status among university students.....	32
Table 3.1 Categories of DASS-21	46
Table 4.1 Socio-demographic characteristics of participants (n=136)	54
Table 4.2 Energy and nutrient intake from UPF among undergraduate students in USM (n=136).....	56
Table 4.3 Depression, anxiety and stress scores among undergraduate students (n=136).....	56
Table 4.4 Correlation between energy and nutrient intake from UPF and depression among undergraduate students (n=136).....	57
Table 4.5 Correlation between energy and nutrient intake from UPF and anxiety among undergraduate students (n=136).....	58
Table 4.6 Correlation between energy and nutrient intake from UPF and stress among undergraduate students (n=136).....	59

LIST OF FIGURES

	Page
Figure 2.1 Conceptual framework of this study	39
Figure 3.1 Screenshot of sample size calculation using G*Power software	44
Figure 3.2 Study flowchart.....	49

LIST OF ABBREVIATIONS

ASEAN	Association of South East Asian Nations
B40	Bottom 40% of the income distribution in Malaysia
BAZ	Body mass index-for-age
BMI	Body mass index
CI	Confidence interval
DOHaD	Developmental origins of health and disease
EBs	Enumeration Blocks
GDP	Gross Domestic Product
GSHS	Global School-based Student Health Survey
IPH	Institute for Public Health
ID	Identification number
LMICs	Low- and middle-income countries
LQs	Living Quarters
M40	Middle 40% of the income distribution in Malaysia
NCD	Non-communicable diseases
RM	Ringgit Malaysia

**PENGAMBILAN MAKANAN ULTRA-PROSES DAN HUBUNGKAIT
DENGAN STATUS KESIHATAN MENTAL DALAM KALANGAN PELAJAR
SARJANA MUDA DI KAMPUS KESIHATAN UNIVERSITI SAINS MALAYSIA**

ABSTRAK

Pengambilan makanan ultra-proses (UPF) semakin meningkat dalam kalangan pelajar universiti disebabkan oleh kemudahan, harga yang murah, dan akses yang mudah. Pada masa yang sama, masalah kesihatan mental seperti kemurungan, kebimbangan, dan tekanan semakin kerap dilaporkan dalam kalangan pelajar universiti. Oleh itu, kajian ini bertujuan untuk menentukan hubungan antara pengambilan UPF dengan status kesihatan mental dalam kalangan pelajar di Universiti Sains Malaysia (USM) Kampus Kesihatan. Kajian keratan rentas telah dijalankan melibatkan 136 orang pelajar yang berumur 19 – 27 tahun. Data dikumpulkan menggunakan soal selidik sosiodemografi, kaedah ingatan semula diet 24 jam, borang soal selidik *Depression, Anxiety, and Stress Scale (DASS-21)*. Nutrien daripada UPF akan dianalisis menggunakan perisian *Nutritionist Pro*, manakala status kesihatan mental dinilai berdasarkan skor (DASS-21). Ujian korelasi Spearman' digunakan untuk menentukan hubungan antara pengambilan UPF dan status kesihatan mental. Median (IQR) pengambilan tenaga daripada UPF ialah 732.72 kcal (Q1 = 480.40 kcal, Q3 = 991.91 kcal). Berdasarkan skor DASS-21, kebanyakan responden menunjukkan tahap kemurungan, kebimbangan, dan tekanan yang normal. Terdapat hubungan positif yang signifikan antara skor kemurungan dengan pengambilan karbohidrat ($r = 0.174$, $p = 0.043$) dan serat ($r = 0.282$, $p < 0.001$) daripada UPF. Skor kebimbangan menunjukkan hubungan positif yang signifikan dengan pengambilan

tenaga ($r=0.266$, $p=0.002$), karbohidrat ($r=0.285$, $p<0.001$), protein ($r=0.231$, $p=0.007$), lemak ($r=0.241$, $p=0.005$), lemak tepu ($r=0.175$, $p=0.043$), serat makanan ($r=0.249$, $p=0.004$), dan zat besi ($r=0.185$, $p=0.032$) daripada UPF. Selain itu, pengambilan serat daripada UPF mempunyai hubungan yang signifikan dengan skor tekanan ($r=0.239$, $p=0.005$). Walau bagaimanapun, semua hubungan yang signifikan adalah lemah. Dapatan kajian ini menekankan kepentingan menggalakkan amalan pemakanan yang lebih sihat serta meningkatkan kesedaran mengenai kesan potensi pengambilan UPF terhadap kesihatan mental pelajar universiti.

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ABSTRACT

Ultra-processed food (UPF) consumption has increased among university students due to its convenience, affordability, and accessibility. At the same time, mental health issues such as depression, anxiety and stress have become more common in young adults. Therefore, the purpose of the current study was to determine the association between UPF consumption and mental health status among undergraduate students in Universiti Sains Malaysia (USM) Health Campus. A cross-sectional study was conducted among 136 undergraduate students aged 19-27 years. Data were obtained through a socio-demographic questionnaire, a 3-day 24-hour dietary recall and the Depression, Anxiety, Stress Scales (DASS-21). Nutritionist Pro software was used to analyse nutrient intake from UPFs, and mental health status was assessed based on DASS-21 scores. Spearman's correlation test was used to determine the relationship between UPF consumption and mental health status. The median (IQR) total energy intake from UPFs was 732.72 kcal (Q1 = 480.40 kcal, Q3 = 991.91 kcal). Most respondents had normal levels of depression, anxiety, and stress. Significant positive correlations were observed between depression scores and carbohydrate intake ($r=0.174$, $p=0.043$) and fibre intake ($r=0.282$, $p < 0.001$) from UPFs. Anxiety scores were positively correlated with energy intake ($r=0.266$, $p=0.002$), carbohydrate intake ($r=0.285$, $p<0.001$), protein intake ($r=0.231$, $p=0.007$), fat intake ($r=0.241$, $p=0.005$), saturated fat intake ($r=0.175$, $p=0.043$), dietary fibre intake ($r=0.249$, $p=0.004$), and iron intake ($r=0.185$, $p=0.032$) from UPFs. In addition, fibre

intake from UPFs was significantly associated with stress scores ($r=0.239$, $p=0.005$). However, all significant correlations were weak in strength. These findings demonstrate the need to encourage healthier eating habits and awareness of the potential impact of UPF consumption on the mental health of university students.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Mental health is a state of mental well-being that enables people to cope with the stresses of life, realise their abilities, learn and work well, and contribute to their community. It has both intrinsic and instrumental value and is a fundamental human right (World Health Organisation, 2025). Mental disorders account for a large proportion of the disease burden in young people globally (Nwachukwu et al., 2021). A recent review by Wang et al. (2021) showed that mental health issues are common among university students around the world. The study found that about 37% of students experienced symptoms of depression, 29% anxiety, and 23% reported stress. The authors found that many students experienced emotional and psychological challenges during their academic years. The transition to university life, combined with academic, financial, and social pressures, are the key factor contributing to these difficulties.

Ultra-processed food (UPF) is a category of processed foods produced through multiple industrial processes and containing numerous dietary additives, such as emulsifiers, sweeteners, and colourants (Monteiro et al., 2019). Over the past few decades, there has been a significant change from consuming whole or minimally processed foods to UPFs. Poor diet quality and unhealthy eating habits have been associated with adverse mental health outcomes. Unhealthy dietary patterns are considered a modifiable risk factor for mental disorders (Adjibade et al., 2019; Mohamed & Kobeissy, 2024). UPFs are primarily composed of substances derived from food that are high in sugar, unhealthy fats, and sodium, but low in essential nutrients such as

vitamins, minerals, and fibre that support brain function and mood regulation. UPF may alter the gut microbiota, which plays a crucial role in emotional and cognitive processes, as it contains additives and heat-generated compounds (Monteiro et al., 2019; Adjibade et al., 2019). This growing body of evidence suggests that frequent UPF consumption may contribute to poor mental health outcomes, especially among university students who often rely on these foods for convenience.

Several socio-demographic factors, including age, gender, household income, and year of study, have been found to influence mental health. Although university students are more likely to benefit from protective characteristics such as higher education, the risk of mental health problems might increase due to sociodemographic factors (Tayefi et al., 2019). Among socio-demographic factors, ethnicity and maternal education were associated with depression and anxiety symptoms among health sciences students. A study found that one in five students in China experienced potential mental health problems. Female students who live in rural areas and those who came from single-parent families were more likely to report symptoms of depression and anxiety. On the other hand, students with better household income, regular sleep patterns, and strong family or social support were less likely to experience psychological distress (Wang et al., 2022). These findings show the importance of considering sociodemographic factors when addressing mental health among university students.

Research on the link between UPF consumption and mental health problems among Malaysian university students is still limited, despite growing proof from around the world. Most local studies focus on physical changes, dietary quality, or body composition in relation to UPF, with little discussion of mental health, especially among university students in Malaysia. Undergraduate students are an important target group for

this research because university years represent a critical life stage during which dietary and lifestyle habits are formed, a period when students are particularly vulnerable to mental health problems (Solomou et al., 2022).

There are several reasons why UPFs are prevalent among university students. University students may have limited access to healthy, home-cooked meals and may depend on readily available, quickly consumable items from vending machines. Additionally, university canteens predominantly offer energy-dense snacks (Racine et al., 2022). Due to budget limitations and prolonged study periods, students often lack the opportunity to cook their own meals (Durán-Agüero et al., 2021). These factors may contribute to the high consumption of UPFs among university students. For example, a Malaysian study found that UPFs contributed about 31% of total daily energy intake among public university students (Ganesrau et al., 2023). At the same time, mental health problems such as depression, anxiety and stress are highly prevalent among university students globally, including in Malaysia, highlighting the vulnerability of this population. (Solomou et al., 2022). Further studies should explore the potential association between UPF consumption and mental health problems, as both are prevalent among university students.

1.2 Statement of the problem

Poor mental health among university students has become an important public health concern worldwide, and if left untreated, it will increase the risk of long-term psychological disorders (Auerbach et al., 2018). University life is a crucial period for establishing healthy eating habits and attitudes (Almoraie et al., 2024). However, university students are at risk of developing poor eating habits due to various factors, including economic conditions, academic stress, and lack of information about nutritional

concepts (Almoraie et al., 2024). University students commonly reported low intakes of fruits, vegetables, whole grains, and dairy, and consumed more energy-dense, high-sugar, and high-fat convenience foods (C. Y. Wong et al., 2023). Furthermore, research has shown that UPF consumption among university students is relatively high, raising concerns about its potential health implications (Fondevila-Gascón et al., 2022).

Several observational studies and systematic reviews have reported that higher UPF intake is associated with increased risk of depression, anxiety, and stress. One study from the French NutriNet-Santé cohort reported that high UPF consumption was positively associated with depressive symptoms (Adjibade et al., 2019). A systematic review and meta-analysis by Lane et al. (2022) found that individuals with higher UPF consumption had significantly higher odds of depressive symptoms.

Similarly, findings from extensive cohort studies indicate that frequent consumption of UPFs is linked to greater psychological distress, including anxiety and stress-related symptoms (Adjibade et al., 2021; Chen et al., 2023). These associations may be partly explained by the poor nutritional quality of UPFs, which are low in essential nutrients linked to brain function and mood regulation, as well as the presence of additives that may influence the gut–brain axis and inflammatory pathways. This growing body of evidence highlights the potential role of UPF consumption as a modifiable risk factor for poor mental health.

Although previous studies have demonstrated an association between UPF consumption and mental health problems, there is limited evidence regarding this relationship among university students in Malaysia. Moreover, the influence of sociodemographic factors, such as age, gender, household income, and year of study, on UPF consumption and mental health status remains insufficiently explored. Therefore,

this study aims to examine the association between UPF consumption and mental health status among undergraduate students at Universiti Sains Malaysia (USM).

1.3 Significance of the study

This study is important since it addresses two emerging health concerns among university students: UPF consumption and increasing mental health challenges. Understanding the association between UPF intake and mental health provides valuable insights into the combined nutritional and psychological risks faced by university students.

The findings of this study can also help health professionals and universities to plan more targeted interventions that can promote healthier eating habits and improve students' mental health. The results could also guide the development of health education programs and campus policies that encourage students to adopt healthier lifestyles and balanced diets.

Additionally, this study adds to the limited local evidence linking UPF consumption use to mental health in Malaysia. The findings can support future research directions and inform national strategies to address mental health issues and unhealthy eating habits among the young generations.

1.4 Research questions

- i. What is UPF consumption among undergraduate students in USM?
- ii. What is the mental health status of undergraduate students in USM?

- iii. Is there any relationship between UPF consumption and the mental health status of undergraduate students in USM?

1.5 Research objectives

1.5.1 General objective

To determine the relationship between UPF consumption and mental health status among undergraduate students in Universiti Sains Malaysia.

1.5.2 Specific objectives

- i. To assess UPF consumption among undergraduate students in USM
- ii. To assess the mental health status of undergraduate students in USM
- iii. To determine the relationship between UPF consumption and mental health status of undergraduate students in USM

1.6 Study hypotheses

- H_0 : There is no significant relationship between UPF consumption and mental health status of USM students.
- H_a : There is a significant relationship between UPF consumption and mental health status of USM students.

CHAPTER 2

LITERATURE REVIEW

2.1 Ultra-processed food (UPF)

2.1.1 Definition of UPF

UPFs are defined within the NOVA classification system, which categorises food based on the extent and purpose of industrial processing. Processes enabling the manufacture of ultra-processed foods include the fractioning of whole foods into substances, chemical modifications of these substances, assembly of unmodified and modified food substances, frequent use of cosmetic additives, and industrial techniques (Sundarassen et al., 2020).

According to the NOVA classification, all foods and food products are categorised into four groups based on the extent and purpose of the industrial processing they undergo. It considers all physical, biological, and chemical methods used during the food manufacturing process, including the use of additives. Ultra-processed foods, as defined using the NOVA food classification system, comprise a range of ready-to-eat products, including packaged snacks, carbonated soft drinks, instant noodles, and ready-made meals. The products are industrially manufactured foods formulated with several ingredients, additives, and preservatives to enhance taste, appearance, and durability, making them hyperpalatable and more durable (Monteiro et al., 2019).

2.1.2 Characteristics of Ultra-processed food

Generally, UPFs have poor nutritional quality and are characterised by high levels of sugar, saturated fat, sodium, and energy density, while being low in dietary fibre,

vitamins, and minerals that are important for maintaining overall health (Monteiro et al., 2019). Frequent consumption of UPFs may contribute to excessive energy intake and inadequate nutrient intake, which can negatively affect nutritional status and increase the risk of various health problems. In addition, many UPFs contain food additives, preservatives, flavour enhancers, artificial sweeteners, and colouring agents that are added to improve taste, texture, appearance, and shelf life (Da Costa Louzada et al., 2021).

These products are often manufactured to be highly palatable, convenient, and ready to eat, making them more attractive to consumers, especially university students with busy lifestyles. Due to their convenience and affordability, students may rely heavily on UPFs as meal replacements or snacks during stressful academic periods. However, regular intake of nutrient-poor foods may replace healthier food choices such as fruits, vegetables, and whole grains, leading to poorer dietary quality and unhealthy eating habits over time. Previous studies have also shown that high UPF consumption is associated with adverse health outcomes, including obesity, cardiovascular diseases, metabolic syndrome, and increased mortality risk (Pagliai et al., 2021). Therefore, the increasing consumption of UPFs among university students has become a growing public health concern.

2.1.3 Common types of UPF among university students

UPF encompass a wide variety of industrially manufactured food products that undergo multiple processing techniques and contain ingredients rarely used in home cooking, such as flavour enhancers, emulsifiers, sweeteners, colourings, and preservatives (Monteiro et al., 2019). According to the NOVA classification system, common examples of UPFs include packaged snacks, sugar-sweetened beverages,

carbonated soft drinks, instant noodles, ready-to-eat meals, breakfast cereals, confectionery products, pastries, biscuits, processed meat products, and fast foods. These products are formulated to be highly palatable, convenient, and have a long shelf life, making them attractive food choices among young adults and university students.

Among university students, some of the most consumed UPFs include instant noodles, burgers, fried chicken, pizza, sausages, nuggets, packaged chips, chocolate products, biscuits, sweetened breakfast cereals, energy drinks, and sugar-sweetened beverages (Fondevila-Gascón et al., 2022). In the Malaysian context, students frequently consume commercially prepared beverages such as canned drinks, flavoured milk, bubble tea, 3-in-1 coffee, and sweetened tea beverages, as well as convenience foods including instant noodles, packaged snacks, and fast foods due to their affordability and easy accessibility (Ganesrau et al., 2023). These food products are widely available in university cafeterias, convenience stores, vending machines, and nearby food outlets, contributing to their regular consumption among students. As a result, UPFs have become a substantial component of university students' dietary patterns and may influence their overall nutritional status and health outcomes.

2.1.4 Prevalence of UPF consumption

The consumption of UPF has increased substantially worldwide and has become a major component of modern dietary patterns, particularly among adolescents and young adults. University students are considered a population with a high risk of UPF consumption due to their busy lifestyles, increased independence in food choices, time constraints, and frequent reliance on convenient, ready-to-eat foods (Durán-Agüero et al., 2021). A study among university students reported that the consumption of ultra-processed foods was common, reflecting the growing dependence on industrially

processed products within this population (Fondevila-Gascón et al., 2022). The increasing availability, affordability, and accessibility of UPFs have contributed to their widespread consumption, making them an important public health concern.

In Malaysia, UPF consumption among university students is relatively high. Ganesrau et al. (2023) reported that ultra-processed foods contributed approximately 31% of the total daily energy intake among public university students, indicating that a substantial proportion of students' diets is derived from UPFs. More recently, a study among Malaysian young adults found that UPFs contributed approximately 38.6% of total energy intake, highlighting the growing presence of these foods in the diets of young populations (Ali et al., 2024). Given that UPFs are generally high in sugar, saturated fat, sodium, and energy density while being low in dietary fibre and essential micronutrients, their increasing consumption among university students may have important implications for both physical and mental health. Therefore, understanding the prevalence of UPF consumption is crucial for developing effective nutritional interventions and promoting healthier dietary behaviours among university students.

Understanding the connection between dietary intake and mental health has received more attention since university students frequently consume UPFs and are also susceptible to mental health issues. Recent studies suggest that high consumption of UPFs may be associated with greater psychological distress, depressive symptoms, and poorer emotional well-being among adults and young populations (Lane et al., 2023). In addition, the poor nutritional quality and high additive content of UPFs may influence mental health through inflammatory pathways and alterations in gut microbiota composition, which play an important role in the gut–brain axis (Taylor et al., 2019). Therefore, examining the association between UPF consumption and mental health status

among university students is important for better understanding the potential impact of dietary behaviours on psychological well-being.

2.1.5 Factors influencing UPF consumption

2.1.5(a) Socio-demographic factors

In university students, some sociodemographic factors have been associated with ultra-processed food (UPF) consumption. Common factors studied include age, sex, household income, educational background and living conditions. A systematic review by Dicken et al. (2023) found that UPF consumption varied across sociodemographic characteristics, with age, sex, and socioeconomic status among the most frequently identified factors. These findings suggest that dietary behaviours are not only due to individual preferences but also to social and economic circumstances.

University students' eating habits can be especially influenced by their living situation and household income. Students with low incomes frequently depend on easily accessible, low-cost food items, including highly processed foods. Additionally, students who live away from home or in college dormitories might have less access to cooking facilities and home-cooked meals, which makes them more dependent on quick, ready-to-eat foods.

Males and females have different eating habits, according to earlier research, though results on sex differences in UPF consumption are still mixed (Whatnall et al., 2021). These results suggest that sociodemographic traits have a significant impact on university students' UPF consumption.

2.1.5(b) Lifestyles factors

Ultra-processed food (UPF) has been identified as being significantly influenced by lifestyle factors. For example, inadequate sleep, a lot of screen time, lack of physical activity, and poor eating habits are among unhealthy lifestyle behaviours linked to an increase the consumption of UPF according to several studies. These behaviours may influence food choices by increasing the preference for convenient, energy-dense, and ready-to-eat products, especially among young adults and university students. Mattar et al. (2022) reported that lifestyle-related factors such as time spent using computers, phones and sleep duration were significantly associated with UPF consumption, suggesting that daily behavioural patterns play an important role in shaping dietary habits. Additionally, individuals with a shorter sleep duration tended to have higher UPF intake than people who had adequate sleep duration.

Sleep quality has also been identified as an important factor associated with UPF consumption. Rocha et al. (2024) reported that inadequate sleep duration was associated with increased consumption of ultra-processed foods, indicating that poor sleep habits may contribute to unhealthy dietary patterns. Similarly, a study among university students found that poorer sleep quality was associated with higher UPF consumption and less favourable eating behaviours (Arslan et al., 2026). In addition, prolonged screen time and sedentary behaviour may increase exposure to food marketing and encourage frequent snacking, further promoting the UPF intake. Therefore, lifestyle factors such as sleep quality, screen time, and physical activity should be considered important determinants of UPF consumption among university students.

2.1.5(c) Academic and environmental factors

Academic and environmental factors have been widely recognised as important determinants of ultra-processed food (UPF) consumption among university students. The transition to university life is often accompanied by increased academic pressure, challenging coursework, examinations, and extracurricular commitments, which may influence students' dietary choices. Students often choose quick, ready-to-eat meals that require easy preparation due to time and competing academic priorities (Whatnall et al., 2021). Studies have shown that university students often rely on ultra-processed foods as quick meal options when they are under a lot of stress and academic pressure, which increases their overall consumption of (Fondevila-Gascón et al., 2022).

The food environment at universities also has a big impact on how students eat. The wide variety of fast food, packaged snacks, beverages, and sugar-sweetened drinks on and around university campuses, along with limited access to cooking facilities and poor food preparation skills, may encourage students to consume more UPFs (Whatnall et al., 2021). Furthermore, social influences such as peers' eating behaviours and campus food culture may affect food choices among university students. Previous studies have reported that students are more likely to develop unhealthy eating habits when exposed to peers who frequently consume convenience foods and energy-dense snacks (Racine et al., 2022). These environmental influences may contribute to the result of unhealthy dietary patterns during university years.

In Malaysia, the impact of academic and environmental factors on UPF consumption is particularly relevant among university students. Ganesrau et al. (2023) reported that ultra-processed foods contributed approximately 31% of total daily energy intake among public university students, indicating substantial reliance on convenience

foods. Busy academic schedules, limited food budgets, and easy access to commercially prepared food products may further encourage the consumption of UPFs among students. Therefore, both academic demands and environmental conditions should be considered important contributors to UPF consumption in university populations.

2.2 Mental health

2.2.1 Definition of mental health

Mental health is defined by the World Health Organisation (WHO) as a state of mental well-being that enables individuals to cope with the stresses of life, realise their abilities, learn and work effectively, and contribute to their communities (World Health Organisation, 2025). Mental health is recognised as a fundamental component of overall health and well-being, extending beyond the mere absence of mental disorders or psychological distress. Good mental health allows individuals to maintain productive daily functioning, build healthy relationships, and adapt to challenges encountered throughout life.

2.2.2 Types of mental health problems

2.2.2(a) Depression

Depression is a common mental health disorder characterised by persistent feelings of sadness, hopelessness, and worthlessness, as well as a lack of interest in once enjoyable activities, which severely disrupts psychosocial functioning and reduces quality of life (Thapar et al., 2022). Individuals with depression may experience emotional, cognitive, and physical symptoms, including fatigue, difficulty concentrating, sleep disturbances, changes in appetite, and reduced motivation to engage in daily activities. Among university students, depression may negatively affect academic performance,

interpersonal relationships, and overall well-being, making it a significant mental health concern in higher education settings.

2.2.2(b) Anxiety

Anxiety disorders are characterised by symptoms of fear, excessive and persistent worry, nervousness, and physiological reactions such as rapid heartbeat, shortness of breath, and muscle tension (Szuhany & Simon, 2022). While anxiety is a normal response to stressful situations, excessive anxiety that persists over time may interfere with an individual's daily functioning and quality of life. University students commonly experience anxiety due to academic demands, examinations, financial concerns, and uncertainty regarding future careers, which may adversely affect their mental and emotional well-being.

2.2.2(c) Stress

Stress is a response that occurs when an individual faces challenging or overwhelming situations that are perceived as difficult to manage, thereby disrupting the body's state of balance (Buenrostro-Jáuregui et al., 2025). Stress activates physiological and psychological processes that help the body adapt to demanding circumstances and restore equilibrium. However, prolonged or excessive stress may negatively affect physical health, emotional well-being, and cognitive functioning. Among university students, common sources of stress include academic workload, examinations, time constraints, financial difficulties, and social pressures, which may contribute to psychological distress if not effectively managed.

2.2.3 Mental health issues among university students

University students are particularly vulnerable to mental health problems due to various academic, social, and lifestyle challenges. The transition from adolescence to

adulthood, adaptation to a new learning environment, financial difficulties, academic workload, and social pressures may contribute to psychological distress among students (Yang et al., 2021). In addition, irregular sleep patterns, lack of social support, and poor coping strategies may further increase the risk of depression, anxiety, and stress (Li et al., 2022). Students may also experience emotional exhaustion resulting from examinations, assignments, and concerns regarding future career prospects, which can negatively affect their mental well-being.

Mental health issues among university students have become an increasing public health concern because of their potential impact on academic performance and overall quality of life. Students experiencing depression, anxiety, and stress are more likely to report fatigue, poor sleep quality, reduced motivation, impaired concentration, and difficulties in maintaining social relationships (Thapar et al., 2022). Furthermore, psychological distress may contribute to unhealthy lifestyle behaviours, including emotional eating, meal skipping, and increased consumption of convenience foods and ultra-processed foods (Solomou et al., 2022). If left unmanaged, mental health problems during university years may persist into adulthood and increase the risk of long-term psychological disorders.

2.2.4 Prevalence of mental health problems

University life often involves demanding academic responsibilities, a new environment, and unfamiliar social situations, making undergraduate students vulnerable to psychological distress. Findings from the World Mental Health International College Student project, with 13,984 first-year students, showed that 31% screened positive for at least one 12-month mental health disorder (Auerbach et al., 2018). High prevalence rates have also been reported in European university populations. In Italy, the prevalence of

stress among university students was reported at 85%, compared to 13% in the general population. Similarly, anxiety affected 65% of students versus 15% in the general population. In comparison, depression affected 46% of students compared to 16% of the general population (Cénat et al., 2020).

In Spain, approximately 10% of university students had suicidal thoughts for the last 12 months (Blasco et al., 2018), highlighting the severity of mental health concerns in higher education settings. Similarly, a study conducted among university students in Spain reported prevalence rates of 18.4% for depression, 23.6% for anxiety, and 34.5% for stress (Ramón-Arbués et al., 2020). Global estimates by Wang et al. (2021) further support the psychological distress, with 37% of students experiencing symptoms of depression, 29% having anxiety, and 23% reporting stress. Collectively, these findings highlight the global burden of mental health among university student populations.

In Asia, mental health problems among university students are also highly prevalent. According to the study's findings, 9.8%, 11.5%, and 6.5% of Chinese university students were found to have depression, anxiety, or depression and anxiety comorbidities in 2023 (Han et al., 2025). A recent systematic review across six Southeast Asian countries reported median prevalences of 29.4% for depression, 42.4% for anxiety, and 16.4% for stress among university students (Dessauvagie et al., 2021). Similar trends are observed in Malaysia. A study in Shah Alam found that 53.9% of university students experienced moderate to extremely severe depression, 66.2% had anxiety, and 44.6% had stress (Wong et al., 2023). These rates were higher than reported previously during the COVID-19 pandemic, whereby the prevalence of depression and anxiety were 29.4% and 51.3%, respectively (Moy & Ng, 2021).

Overall, these results show that mental health issues are prevalent among college students in Asian countries, with Malaysian students experiencing exceptionally high levels of stress, anxiety, and depression. This shows how critical it is to identify modifiable causes of poor mental health among Malaysian university students.

Table 2.1 shows that mental health problems among university students remain highly prevalent across different countries. Anxiety was commonly reported as the most prevalent psychological problem, followed by depression and stress. Malaysian university students reported particularly high prevalence rates compared to several other countries (Wong et al., 2023). Similar findings were also observed among university students in China and other Asian countries, indicating that mental health issues among students are a growing global concern (Han et al., 2025; Hasan et al., 2025). These findings suggest that university students are a vulnerable population for psychological distress and require greater mental health support. The consistently high prevalence rates reported across different regions highlight the importance of identifying factors associated with mental health problems among university students.

Table 2.1 Prevalence of mental health status among university students

Author (Year)	Country	Population	Instrument	Depression (%)	Anxiety (%)	Stress (%)
Wang et al. (2021)	Global	College students	Meta-analysis	37	29	23
Ramón-Arbués et al. (2020)	Spain	University students	DASS-21	18.4	23.6	34.5
Wong et al. (2023)	Malaysia	University students	DASS-21	53.9	66.2	44.6
Han et al. (2025)	China	University students	Mental health screening tools	9.8	11.5	NR
Hasan et al. (2025)	Southeast Asia	University students	Systematic review	29.4	42.4	16.4

2.2.5 Factors influencing mental health problems

2.2.5(a) Academic stress

Academic stress is one of the most common factors influencing mental health among university students. University life often involves demanding coursework, examinations, assignments, practical sessions, and the need to balance academic responsibilities with personal and social commitments. As students transition from secondary education to higher education, they are required to adapt to a more challenging learning environment, which may increase psychological distress and negatively affect their mental well-being (Yang et al., 2021). Excessive academic demands may contribute to feelings of pressure, emotional exhaustion, and reduced ability to cope with daily challenges.

Previous studies have consistently reported that academic stress is associated with increased levels of depression, anxiety, and stress among university students. Concerns regarding academic performance, examination outcomes, graduation requirements, and future career prospects may further contribute to mental health problems (Li et al., 2022). Health sciences students may be particularly vulnerable due to additional academic responsibilities, including laboratory work, clinical training, practical assessments, and professional competency requirements. Persistent academic stress may impair concentration, reduce academic performance, and negatively affect students' quality of life (Thapar et al., 2022).

Furthermore, prolonged exposure to academic stress may influence unhealthy lifestyle behaviours that further compromise mental health. Students experiencing high levels of stress may report poor sleep quality, emotional eating, meal skipping, and reduced participation in physical activities (Solomou et al., 2022). If academic stress is

not effectively managed, it may increase the risk of long-term psychological distress and contribute to the development of more severe mental health problems. Therefore, academic stress remains an important factor influencing mental health among university students.

2.2.5(b) Dietary habits and nutrition

Dietary habits and nutritional intake are important factors that influence mental health and psychological well-being. Nutrition plays a crucial role in brain function, neurotransmitter synthesis, immune regulation, and emotional regulation. Previous evidence suggests that individuals who consume healthier diets rich in fruits, vegetables, whole grains, legumes, and other nutrient-dense foods generally report better mental health outcomes, whereas diets characterised by high intakes of sugar, saturated fat, and highly processed foods are associated with increased risks of depression, anxiety, and psychological distress (Grajek et al., 2022).

Among university students, unhealthy dietary behaviours are common due to academic demands, irregular schedules, and limited time for meal preparation. These behaviours often include meal skipping, inadequate consumption of nutrient-rich foods, and increased reliance on convenience foods. A cross-sectional study among university students in Lebanon found that nutritional habits were significantly associated with mental health outcomes, highlighting the importance of healthy eating behaviours in maintaining psychological well-being (Boutros et al., 2026). Students with poorer dietary practices were more likely to experience adverse mental health outcomes compared to those who adhered to healthier eating patterns.

Furthermore, emerging evidence suggests that dietary habits may influence mental health through the gut–brain axis. Diet affects the composition and diversity of

gut microbiota, which may subsequently influence mood, cognitive function, and emotional regulation. Sălcudean et al. (2025) reported that unhealthy dietary patterns may contribute to alterations in the gut microbiome that are associated with poorer mental health outcomes. Therefore, maintaining a balanced and nutritious diet may play an important role in supporting mental health and reducing the risk of depression, anxiety, and stress among university students.

2.3 Association between UPF consumption and mental health

A systematic review and meta-analysis revealed a significant association between UPF consumption and poor mental health outcomes, where individuals with higher UPF intake had approximately 1.4 to 1.5 times greater odds of experiencing mental health problems compared to those with lower intake (Lane et al., 2022). A possible explanation for this is the characteristics of UPFs that can affect mental health, such as high energy density, which contributes to higher adiposity, and sensorial attributes (Lane et al., 2023). These findings provide evidence that excessive UPF consumption may negatively affect psychological well-being.

Several studies consistently reported that higher UPF consumption was more strongly associated with depressive symptoms than anxiety and stress outcomes. A dose-response relationship was also observed in some cohort studies, in which higher UPF intake was associated with an increased risk of psychological distress (Adjibade et al., 2019). However, some studies reported weaker or non-significant associations after adjusting for lifestyle and socioeconomic factors, suggesting that multiple interacting factors may influence the relationship between UPF consumption and mental health. Differences in study design, methods of assessing diet, and tools used to measure mental health may also account for inconsistencies across findings.

University students may be particularly vulnerable to the mental health effects of UPF consumption due to their high reliance on convenience foods. Studies have shown that students frequently consume UPFs due to academic stress, tight schedules, limited cooking facilities, and financial difficulties (Ganesrau et al., 2023). At the same time, this population already experiences elevated levels of stress, anxiety, and depression, potentially amplifying the adverse effects of poor dietary patterns on mental well-being (Wang et al., 2021). Therefore, understanding the relationship between UPF consumption and mental health among university students is important for developing appropriate nutritional and mental health interventions in this population.

Several biological mechanisms have been developed to explain the association between eating UPFs and poor mental health outcomes. One of the most frequently discussed mechanisms is chronic low-grade inflammation. The high levels of added sugars, saturated fats, and other food additives in ultra-processed foods may promote inflammatory responses and increase the production of pro-inflammatory cytokines. Chronic inflammation has been linked to the growth of depression, anxiety, and other neuropsychiatric disorders, suggesting a potential mechanism by which UPFs might negatively impact mental health (Lutz et al., 2025).

Oxidative stress has also been identified as a potential mechanism linking UPF consumption with mental health disorders. Diets high in ultra-processed foods are often deficient in antioxidants, vitamins, minerals, and other nutrients that help protect against oxidative damage. Increased oxidative stress may impair neuronal function, alter neurotransmitter activity, and contribute to mood disturbances and depressive symptoms (Lutz et al., 2025). Furthermore, Poon et al. (2026) suggested that UPFs may influence

lipid metabolism and neurobiological processes involved in emotional regulation, potentially increasing susceptibility to mental health conditions.

Frequent consumption of UPFs may negatively affect mental health through several biological pathways, including inflammation, oxidative stress, and changes in the composition of gut microbiota (Monteiro et al., 2019). The nutritional content of ultra-processed foods has been linked to the development and severity of depression through several biological pathways, including inflammation, oxidative stress, and changes in the gut microbiome. Moreover, research indicates that as the consumption of ultra-processed foods increases, fresh or minimally processed foods are frequently replaced in the diet, which lowers overall nutritional quality in the diet (Da Costa Louzada et al., 2021). Additionally, in UPFs, common emulsifiers and food additives are present that can disrupt gut microbiota composition, potentially affecting the gut-brain axis and emotional regulation (Taylor et al., 2019).

Another important mechanism involves the gut–brain axis. Emerging evidence suggests that emulsifiers, artificial sweeteners, preservatives, and other additives commonly found in UPFs may alter the composition and diversity of gut microbiota (Contreras-Rodriguez et al., 2022). Changes in the gut microbiome may affect immune function, neurotransmitter production, and bidirectional communication between the gastrointestinal tract and the brain, thereby influencing mood and behaviour. In addition, ultra-processed foods have been reported to stimulate brain reward pathways through their high palatability, potentially promoting compulsive eating behaviours and increasing the risk of adverse mental health outcomes (Wiss & LaFata, 2024). Therefore, inflammation, oxidative stress, alterations in gut microbiota, and neurobiological changes

may collectively explain the relationship between UPF consumption and poor mental health.

2.4 Conceptual framework

This study is guided by a conceptual framework (Figure 2.1) that illustrates the relationship between ultra-processed food (UPF) consumption and mental health status among undergraduate students. Mental health status is the outcome variable, measured in terms of depression, anxiety, and stress.

UPF consumption is the main independent variable and forms part of overall food intake, which may influence mental health status directly. In addition to UPF consumption, food intake may also include other dietary factors such as high sugar intake and alcohol intake; however, these variables are not included in the present study.

Individual factors such as age, sex, household income, and year of study were collected as socio-demographic characteristics of the participants. These variables were used to describe the study population and were not analysed as independent variables in relation to mental health status in the present study.

The framework also acknowledges the role of lifestyle behaviours, such as physical activity, smoking, and sleep patterns, which may affect mental health status. However, these lifestyle behaviour variables are not included in this study and are shown in the framework to indicate potential pathways based on existing literature.

Overall, the conceptual framework demonstrates that UPF consumption may be associated with mental health status, while individual factors may act as influencing variables in this relationship.