UNIVERSITI PUTRA MALAYSIA

ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC, BODY MASS INDEX, BODY IMAGE PERCEPTION, PHYSICAL ACTIVITY AND SLEEP QUALITY WITH MENTAL HEALTH AMONG UNIVERSITY STUDENTS IN UNIVERSITI PUTRA MALAYSIA DURING THE COVID-19 PANDEMIC

FARRAH HALINY BINTI KUDIN

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BY

FARRAH HALINY BINTI KUDIN

A project submitted as a partial fulfilment of the requirement for the degree of Bachelor of Science (Nutrition and Community Health) form the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

APPROVAL

This project entitled "Associations between Sociodemographic, Body Mass Index, Body Image Perception, Physical Activity and Sleep Quality with Mental Health among University Students in Universiti Putra Malaysia during the COVID-19 Pandemic" was prepared by Farrah Haliny binti Kudin and submitted to the Faculty of Medicine and Health Sciences as a partial fulfilment of the requirement for the degree of Bachelor of Science (Nutrition and Community Health) from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

Received and examined by:

(Dr. Noraida Omar)

DR NORAIDA OMAR
Pensyarah Kanan
Jabatan Dietetik
Fakulti Perubatan dan Sains Kesihatan
Universiti Putra Malaysia

Date: 29.9.2021

DECLARATION

I hereby declare that this thesis report is based on my original work except for quotations and citations which have been acknowledge to the corresponding authors.

(Farrah Haliny binti Kudin)

Matric number: 191963

Bachelor of Science (Nutrition and Community Health)

Department of Nutrition

Faculty of Medicine and Health Sciences

Universiti Putra Malaysia

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LIST OF ABBREVIATIONS

BAI	- Beck Anxiety Inventory
BDI	- Beck Depression Inventory
BDS	- Body Discrepancy Scale
BMI	- Body Mass Index
B. SC.	- Bachelor Science
BSQ	- Body Shape Questionnaire
CESD	- Centre of Epidemiological Studies Depression
COVID-19	- Corona Virus Disease 2019
CPDI	- COVID-19 Peritraumatic Distress Index
DASS	- Depression, Anxiety and Stress Scale
DEFF	- Design effect
GAD	- Generalized Anxiety Disorder
GPAQ	- Global Physical Activity Questionnaire
HDM	- Human Development and Management
IES-R	- Impact of Event Scale-Revised
ID	- Industrial Design
IPAQ	- International Physical Activity Questionnaire
MB	- Molecular Biology
MBSRQ-AS	- Multidimensional Body-Self Relations Instruments-Appearance Scales
NHMS	- National Health and Morbidity Survey
PHQ	- Patient Health Questionnaire
PSQI	- Pittsburgh Sleep Quality Index
PTSD	- Post-traumatic Stress Disorder
QoL	- Quality of Life
SAS	- Self-rating Anxiety Scale

ABSTRACT

ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC, BODY MASS INDEX, BODY IMAGE PERCEPTION, PHYSICAL ACTIVITY AND SLEEP QUALITY WITH MENTAL HEALTH AMONG UNIVERSITY STUDENTS IN UNIVERSITI PUTRA MALAYSIA DURING THE COVID-19 PANDEMIC

Farrah Haliny Kudin

COVID-19 pandemic affected one's mental health and this include university students. Mental health problems among university students became one of the global main issues. There is limited study on factor associated with mental health among university student during this COVID-19 pandemic. Therefore, this study aimed to determine the associations between socio-demographic, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia. This is a cross-sectional study with a total sample of 130 students aged 18 to 25 years old. The respondents were recruited through a multistage sampling. An online self-administered questionnaire was used to collect the data on socio-demographic characteristics, weight and height, body image perception (Body Shape Questionnaire-8C, BSQ-8C), physical activity (Global Physical Activity Questionnaire, GPAQ), sleep quality (Pittsburgh Sleep Quality Index, PSQI), and mental health which was accessed using 21-items Depression Anxiety Stress Scale (DASS-21). Majority of the respondents were female (76.2%), Malay (78.5%), in second year of study (28.5%), from low income family (59.2%) and stayed with parents during COVID-19 pandemic (57.7%). Results showed 44.6% of respondents had depressive symptoms, 56.9% had anxiety symptoms and 29.2% had stress symptoms with severity mild to extremely severe. Body mass index (r=0.205, p<0.05), body image perception (r=0.538, p<0.01), and sleep quality (r=0.460, p<0.01) were significantly associated with depression subscale. Meanwhile, body image perception (r=0.449, p<0.01), and sleep quality (r=0.450, p<0.01) were significantly correlated with anxiety subscale. Stress subscale was significantly correlated with body image perception (r=0.473, p<0.01) and sleep quality (r=0.492, p<0.01). Socio-demographic characteristics and physical activity were not correlated with depression, anxiety and stress. Affected students should be helped and referred to healthcare practitioner to ensure they able to overcome with these problems and remains healthy during this pandemic.

ABSTRAK

HUBUNGKAIT ANTARA SOSIODEMORGAFI, INDEKS JISIM BADAN, PERSEPSI IMEJ BADAN, AKTIVITI FIZIKAL DAN KUALITI TIDUR DENGAN KESIHATAN MENTAL DALAM KALANGAN PELAJAR UNIVERSITI DI UNIVERSITI PUTRA MALAYSIA SEMASA PANDEMIK COVID-19

Farrah Haliny Kudin

Wabak COVID-19 mempengaruhi kesihatan mental seseorang dan ini termasuk pelajar universiti. Masalah kesihatan mental dalam kalangan pelajar universiti menjadi salah satu isu utama global. Kajian mengenai faktor yang berkaitan dengan kesihatan mental dalam kalangan pelajar universiti semasa wabak COVID-19 ini adalah terhad. Sehubungan dengan itu, kajian ini bertujuan untuk mengetahui perkaitan antara sosiodemografi, indeks jisim badan, persepsi imej badan, aktiviti fizikal dan kualiti tidur dengan kesihatan mental dalam kalangan pelajar universiti di Universiti Putra Malaysia. Ini adalah kajian keratan rentas dengan jumlah sampel 130 pelajar berumur 18 hingga 25 tahun. Responden direkrut melalui pensampelan pelbagai peringkat. Soal selidik kendiri secara atas talian telah digunakan untuk mengumpulkan data mengenai ciri sosiodemografi, berat dan tinggi badan, persepsi imej badan (Body Shape Questionnaire-8C, BSQ-8C), aktiviti fizikal (Global Physical Activity Questionnaire, GPAQ), kualiti tidur (Pittsburgh Sleep Quality Index, PSQI) dan kesihatan mental yang diakses menggunakan 21 item Depression Anxiety Stress Scale (DASS-21). Majoriti responden adalah wanita (76.2%), Melayu (78.5%), di tahun kedua pengajian (28.5%), dari keluarga berpendapatan rendah (59.2%) dan tinggal bersama ibu bapa semasa wabak COVID-19 (57.7%). Hasil kajian menunjukkan 44.6% responden mengalami gejala kemurungan, 56.9% mengalami gejala kegelisahan dan 29.2% mempunyai gejala tekanan dengan darjah keparahan ringan hingga sangat teruk. Indeks jisim badan (r=0.205, p<0.05), persepsi imej badan (r=0.538, p<0.01), dan kualiti tidur (r=0.460, p<0.01) dikaitkan secara signifikan dengan subskala kemurungan. Sementara itu, persepsi imej badan (r=0.449, p<0.01), dan kualiti tidur (r=0.450, p<0.01) berhubungkait secara signifikan dengan subskala kegelisahan. Subskala tekanan berhubungkait secara signifikan dengan persepsi imej badan (r=0.473, p<0.01) dan kualiti tidur (r=0.492, p<0.01. Ciri sosiodemografi dan aktiviti fizikal tidak berkaitan dengan kemurungan, kegelisahan dan tekanan. Pelajar yang terjejas harus dibantu dan dirujuk kepada pakar kesihatan untuk memastikan mereka dapat mengatasi masalah ini dan tetap sihat sepanjang wabak ini.

CHAPTER 1

INTRODUCTION

1.1 Background

According to World Health Organization (2018), mental health is defined as "a state of well-being where an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community". It is a complex and complicated public health problem that can affect social, economic and physical health (National Health and Morbidity Survey, 2015). A disturbance in the mood, thinking and behaviour that can cause difficulty to cope with daily life activities is called mental illness or mental health disorders (Malaysian Mental Health Association, 2019). There are many types of mental illness include depression, anxiety, bipolar, schizophrenia stress and others (Malaysian Mental Health Association, 2019).

World Health Organization (2018) stated that mental illness is the growing public health concern that contributes to 16% of the global burden of disease injury among youths. The statistics of mental illness in the year 2019 with age range 18-25 shows that 29.4% of the United State population had any mental illness based on the criteria from DSM-IV(National Survey on Drug Abuse and Health, 2019). The percentage of mental illness based on age group was increased by 3% compared to 2018 (26.3%) (National Survey on Drug Abuse and Health, 2019). Any mental illness is defined as having diagnosable mental, behavioural or emotional disorder

other than developmental or substance use of mental disorder (National Survey on Drug Abuse and Health, 2019). The proportion of any mental health illness in the year 2019 was higher in female (24.5%) compared to male (16.3%) and both statistics recorded higher by 1.7% and 1.1% compared to the year 2018 respectively (National Survey on Drug Abuse and Health, 2019).

Our neighbour country, Singapore reported that 1 in 7 Singaporean has experienced a mental disorder in their lifetime (Singapore Mental Health Study, 2016). The lifetime prevalence of mental illness was increase in the 2016 study compared to 2010 study with proportion 13.9% and 12% (Singapore Mental Health Study, 2016). In Malaysia, there is increasing trend in the statistics of mental illness among those aged 16 to 24 years old. The prevalence of mental illness increased from 21.0% in 2006 to 66.8% in 2015 (National Health and Morbidity Survey, 2006, 2015). This age group recorded the highest mental illness statistics compared to the others age group. Depression, anxiety and stress are the common mental health issues that occur among youths in universities (Ashraful et al., 2018; Latiff et al., 2014; Shamsuddin et al., 2013).

There were 11% of university students in United State had severe to extremely severe depression (Beiter et al., 2015). In Malaysia, the prevalence of moderate to extremely severe depression among university students was 21% (Amir Hamzah et al., 2019). Other local study found that almost 30% of Malaysian university students suffered from moderate to severe depression (Ashraful et al., 2018). Other than depression, the prevalence of anxiety also been found high among university students in Malaysia with the percentage 30% to 60% (Ashraful et al., 2018; Latiff et al., 2014; Rozita Manap et al., 2019). Meanwhile, the prevalence of

stress was found decreased from 23.7% I 2013 to 12% in 2019 (Amir Hamzah et al., 2019; Latiff et al., 2014; Rozita Manap et al., 2019; Shamsuddin et al., 2013).

University student is one of the population groups that have the tendency to acquire mental health problem. They are a special group of people in critical phase in life shifting from adolescence to adulthood and believed as one of the most stressful moments in a person's life (Ashraful et al., 2018). University students had major responsibilities to contribute to their families and country in future (Ashraful et al., 2018). There are many factors that associated with mental health problem such as gender (Jia & Loo, 2018; Mokhtari et al., 2015; Wathelet et al., 2020), family income (Mokhtari et al., 2015; Sherman et al., 2020; Wathelet et al., 2020), sleeping problem (Ashraful et al., 2018; Zhang et al., 2018), body weight status (Mokhtari et al., 2015; Tashakori et al., 2016) and social relationship (Wathelet et al., 2020).

1.2 Problem Statement

The state of mental health among population had become one of the global main issues especially during this COVID-19 pandemic. The feeling of fear, worry and stress in facing the COVID-19 pandemic with the life challenges to survive can affect the mental health of individuals. People had to face the new norm of working from home, temporary employment, home-schooling of children and lack of physical contact with other family members, friends and colleagues (World Health Organization, 2020). There is an urgent need for research on mental health consequences for vulnerable groups that can be mitigated under pandemic conditions, and on the impact of repeated media consumption and health messaging around COVID-19 (Holmes et al., 2020).

A study had been done on the outcome of mental health of population in United State during the COVID-19 pandemic. Sherman et al. (2020) reported that 20% of participants had clinically increased levels of depressive symptoms, 16.58 % reported increased anxiety symptoms and 5.38% reported increased levels of trauma symptoms. Meanwhile, in other study in China reported that the prevalence of probable post-traumatic stress disorder (PTSD) and depression was determined to be 2.7% and 9.0% respectively (Tang et al., 2020). Another study in China reported the prevalence of anxiety and depression among university student during the COVID-19 pandemic was 7.7% and 12.2 % respectively (Wang et al., 2020).

Self-rated body image (SRBI) dissatisfaction, underweight SRBI, overweight or obese SRBI were significantly linked with students' depression and anxiety (Hossain et al., 2020). Eating disorders were more likely to be associated with depression (Wildes et al., 2005). Wildes et al. (2005) found that there was no significant difference between depressed and body dissatisfaction. Adolescents who underweight and overweight or obese were found to have the risk of body dissatisfaction and they were more likely to became more concern on their body weight and shape (Calzo et al., 2012). However, this finding was mainly significant based on the gender aspect (Calzo et al., 2012). A meta-analyses on 19 studies found that body satisfaction was found significantly associated with anxiety (r=0.40) and depression (r=0.34) (Barnes et al., 2020). In Malaysia, a study found that body mass (BMI) had significant relationship with anxiety among the university students (Mokhtari et al., 2015).

The associations between physical exercise, depression, and stress have already been widely discussed (Chen et al., 2020). According to Chen et al. (2020), college students who practice physical exercise had fewer depressive symptoms.

Weinstein et al. (2015) found that exercise for recreational purpose showed an association between ratings of compulsive exercise and depression but not with ratings of trait anxiety. This study was conducted among the professional and recreational regular exercisers. On the other hand, physical activity was associated with depression among university student but it was found as insignificantly predictor as it was predicted to be the confounding effect (Ashraful et al., 2018).

Sleep quality is one of the probable factors that associate with depression during the COVID-19 pandemic. A study by Chen (2020) shows that sleeping times later than 24:00 or irregular bedtimes was associated with depressive symptoms among university students in China. People with short sleep durations (<6 hours/ night) was found more likely to experience post-traumatic sleep disorder (PTSD) and depressive symptoms (Tang et al., 2020). University students in Malaysia with sleeping problem was more likely to have depression problem (Ashraful et al., 2018). However this study was conducted before the outbreaks of COVID-19.

The prevalence of mental health among youth students in Malaysia are mostly depends only on the survey conducted by National Institute of Health and some of the research study done by researchers. The updated prevalence of mental health and its associated factors among university students need to be done so that an intervention program and treatment can be done to help individuals who affected. Therefore, this study is aimed to determine the association between sociodemographic, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic.

1.3 Research Questions:

1. What is the sociodemographic, body mass index, body image perception, physical activity and sleep quality among university students in Universiti Putra Malaysia during the COVID-19 pandemic?
2. What is the mental health status among university students in Universiti Putra Malaysia during the COVID-19 pandemic?
3. Is there any association between sociodemographic, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic?

1.4 Significance of the Study

There is no published study has been conducted on the mental health status and its association with body mass index, body imager perception, physical activity and sleep quality among university students in Universiti Putra Malaysia due to COVID-19. This study can be used as the one of the source for future research. The result from this study can be used as the baseline data for future intervention program for university students. The findings of this study can create awareness among population and be more understanding towards university students. Furthermore, any agency, organization or association can send their expert to help those affected with mental health.

1.5 Research Objectives

1.5.1 General Objectives

To determine the associations between sociodemographic, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic.

1.5.2 Specific Objectives

1. To determine the sociodemographic (age, gender, ethnicity, marital status, year of study, programme of study, faculty, family monthly income, location of stay during COVID-19 pandemic), body mass index, body image perception, physical activity, sleep quality of university students.
2. To determine the mental health status of university students.
3. To determine the associations between sociodemographic, body mass index, body image perception, physical activity and sleep quality with mental health of university students

1.6 Research Hypothesis

There are significant associations in sociodemographic, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic.

1.7 Research Framework

As shown in Figure 1.1, sociodemographic, body mass index, body image perception, physical activity and sleep quality are the variables need to be finding the association with the mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic.

Sherman et al. (2020) found that women and individuals from lower family incomes were significantly showed depression and anxiety symptoms. On the other hand, Latiff et al. (2014) found that gender was associated with depression and ethnicity was associated with depression anxiety and stress. Meanwhile family income had no association with depression, anxiety and stress. Year of study had also be found associate with depression among university students (Ashraful et al., 2018).

Porter et al. (2012) found that body mass index (BMI) percentile was positively associated with the body satisfaction. This relation can be assumed that body mass index (BMI) can be the variable that associated with depression. Body satisfaction measured by Body Discrepancy Score (BDS) which show the large discrepancies between ideal and current body image was positively associated with depressive symptoms (Porter et al., 2012). The result was consistent with a study conducted by Scheffers et al. (2019) where their finding indicated that in clinically depressed patients, body experience, especially body satisfaction, improves after treatment, with strong associations between depressive symptoms and body satisfaction.

Lun et al. (2018) found that regular exercise could decrease the occurrence of depression via both physiological and psychological mechanisms. A study conducted among community-dwelling adults showed that exercise can reduce the score of depressive (McHugh & Lawlor, 2012)

Mohan et al. (2017) found that excess or lack of sleep increased the risk of depression especially those who had less than 6 hours or more than 9 hours of sleep duration compared to those who slept 6 to 8 hours. Similarly, Tang et al. (2020)

found that shorter or longer sleep durations were significantly associated with mental health consequences such as post-traumatic sleep disorder (PTSD) and depression.

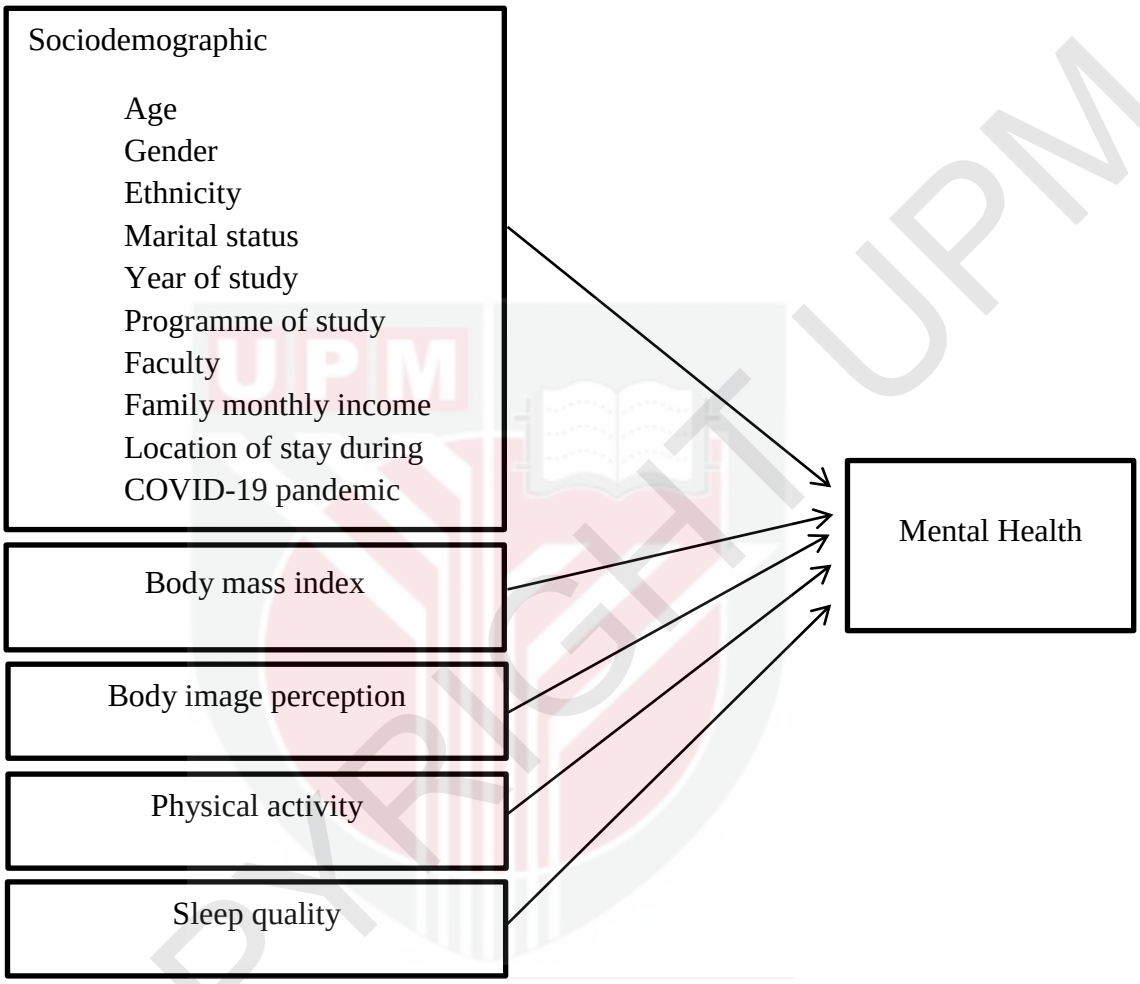

Figure 1.1: Conceptual framework of this study

CHAPTER 2

LITERATURE REVIEW

2.1 Mental Health

Depression, anxiety and other mental health problems become more prevalent due to the increasing demand in living (Rozita Manap et al., 2019). Depression is a major illness that is on the rise all over the world and threaten human health (Tashakori et al., 2016). Latiff et al. (2014) said that majority of mental problems diagnosed in adulthood may have begun earlier during adolescence period. The COVID-19 pandemic has dramatically affected the working people and institutions around the world (Sherman et al., 2020). The widespread change due to COVID-19 pandemic such as lack of approved vaccines, restriction to work and recreation, unemployed and reduced income might contribute to a range of psychosocial problems included social segregation, anxiety, self-destructive, and harm (Sherman et al., 2020).

The first nationwide large-scale survey of psychological distress in the general population of China (52 730 valid responses from 36 provinces, autonomous regions and municipalities, as well as from Hong Kong, Macau and Taiwan) during the initial time of the COVID-19 epidemic reported that almost 35% of the respondents experienced psychological distress (29.29% of the respondents' scores were between 28 and 51, and 5.14% of the respondents' scores were ≥52) (Qiu et al., 2020). This study found that 18-30 years old respondents were scored the high COVID-19 Peritraumatic Distress Index (CPDI) score (27.76 ± 15.69). This study

used the COVID-19 Peritraumatic Distress Index (CPDI) that asked about the frequency of anxiety, depression, specific phobias, cognitive change, avoidance and compulsive behaviour, physical symptoms and loss of social functioning in the past week, ranging from 0 to 100 which had been verified the content validity of the CPDI (Cronbach's alpha of CPDI is 0.95 (p<0.001) by the psychiatrists from the Shanghai Mental Health Center (Qiu et al., 2020).

Recently, a study on the mental health outcome during the outbreak of COVID-19 was conducted in Southern United State reported that 21% of participants reported clinically elevated levels of depressive symptoms on the 9-item Patient Health Questionnaire (PHQ-9). The study was conducted over 591 individuals with majority of the respondents were older (p=0.001) and white (p=0.001), and most of them female (p=0.011) (Sherman et al., 2020). This study had the strength where it was conducted with a large sample, clinically relevant results, and focused to pandemic-related risk factors are among the prominent characteristics of the study. However, there is some limitation and one of it excluded any inferences about casual relationships.

In China, a study from general population which involved 1210 respondents found that more than half (53.8%)of the respondents reported the psychological impact as moderate to severe during the initial outbreak of the COVID-19 in China (Wang et al., 2020). According to the DASS-21 on the depression subscale, almost 70% were considered to have a normal score, 13.8% were considered to suffer from mild depression and 16.5% were considered to suffer from moderate to extremely severe depression (Wang et al., 2020). For anxiety subscale, almost 64% were recorded the normal score, 7.5% recorded the mild anxiety score and 28.4% were considered to have moderate to extremely severe anxiety score (Wang et al., 2020).

For the stress subscale, 67.8% were had the normal score, 24.1% were had the mild score and 8.1% were considered suffer from moderate to extremely severe stress (Wang et al., 2020). From the findings, the highest psychological impact to the China population during the initial outbreak of COVID-19 pandemic was anxiety followed by depression and stress.

In Malaysia, limited published study was done on the mental health status of Malaysian during the outbreak of COVID-19. The available current data for the mental health status in Malaysia was from the National Health and Morbidity Survey (NHMS) 2015, National Health and Morbidity (NHMS) 2019 and several studies from the local researchers that were done before the COVID-19 pandemic.

2.1.1 Table of summary for mental health

Table 2.1 showed the summary for the previous study conducted on the mental health

Table 2.1: Summary for mental health

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	Depression, anxiety and stress among undergraduate students Rozita Manap et al. 2019	• 91 undergraduate students aged 18 to 21 years old from private university • Instruments: – Depression Anxiety Stress Scale (DASS-21) – Self-administered (sociodemographic characteristics)	• Depression, anxiety and other mental health problems become more prevalent due to the increasing demand in living
2.	The relationship between body mass index and depression among high school girls in Ahvaz Tashakori et al. 2016	• Descriptive analytical study • Use stratified random sampling • Instruments – Depression use Beck Depression Instruments (BDS) • 400 female students	• Depression is a major illness that is on the rise all over the world and threaten human health
3.	Prevalence of mental health problems and the associated factors among undergraduate students in a public university, Malaysia	• Cross-sectional study • Students aged 19-25 years old	• majority of mental problems diagnosed in adulthood may have begun earlier during adolescence period

	Latiff et al. 2014	• Stratified sampling from randomly selected faculties • Instruments – Depression Anxiety Stress Scale (DASS-21) – Body Shape Instruments-8C (BSQ-8C) • 385/481 completed questionnaire (80% response rate)	
4.	Mental health outcome associated with the COVID-19 pandemic: Prevalence and risk factors in a southern US state Sherman et al. 2020	• Cross-sectional registry-based observational study (online survey) • 591/1672 respondents completed survey • Instruments – 9-items Patient Health Questionnaire (PHQ-9) – 7-items General Anxiety Disorder (GAD-7) – 20-items PTSD checklist for DSM-5 (PCL-5) – 3-items AUDIT-C(alcohol usage)	• The COVID-19 pandemic has had a dramatic effect on the functioning of individuals and institute on around the world • The widespread change due to COVID-19 pandemic – lack of approved vaccines – restriction to work and recreation, – unemployed – reduced income might contribute to a range of psychosocial problems included social segregation, anxiety, self-destructive, and harm • 21% of participants reported clinically increased levels of depressive symptoms on the PHQ-9.

			• Majority of respondents were older (p=0.001) and white (p=0.001), and most of them female (p=0.011) • Strength – large sample, range of clinically relevant results, and focused to pandemic-related risk factors are among the prominent characteristics of the study. • Limitation – excluded any inferences about casual relationships
5.	A nationwide survey of psychology distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations Qiu et al. 2020	• Designed self-report questionnaire to survey peritraumatic psychological distress during epidemic – COVID-19 Peritraumatic Distress Index (CPDI) • 52 730 valid responses from 36 provinces, autonomous regions and municipalities, as well as from Hong Kong, Macau and Taiwan	• Almost 35% of the respondents experienced psychological distress – 29.29% of the respondents' scores were between 28 and 51 – 5.14% of the respondents' scores were ≥52 • 18-30 years old respondents were scored the high CPDI score (27.76 ± 15.69). • CPDI tasked about – the frequency of anxiety, depression, specific phobias, cognitive change, avoidance and compulsive behaviour, physical symptoms and loss of social functioning in the past week, ranging from 0

			to 100 – been verified the content validity of the CPDI (Cronbach's alpha of CPDI is 0.95 (p<0.001) by the psychiatrists from the Shanghai Mental Health Center
6.	Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the general population in China Wang et al. 2020	• Online survey using snowball sampling techniques. • 1210 respondents from 194 cities in China • Instruments – Impact of Event Scale-Revised (IES-R) for psychological impact – Depression, Anxiety and Stress Scale (DASS-21) for mental health status	• 53.8% of respondents rated the psychological impact of the outbreak as moderate or severe • Depression subscale, – almost 70% have a normal score – 13.8% suffer from mild depression – 16.5% suffer from moderate to extremely severe depression • Anxiety subscale – almost 64% recorded the normal score – 7.5% recorded the mild anxiety score – 28.4% have moderate to extremely severe • Stress subscale, – 67.8% were had the normal score; – 24.1% had the mild score – 8.1% suffer from moderate to extremely severe

2.2 Mental Health among University Students

Mental health issues had significant problems for many college students (Beiter et al., 2015). It is significant to study on their depression problem because of their potential role in society, as well as in the country (Ashraful et al., 2018). Depression, anxiety and stress causes mental health problem among young group especially university students that resulted from the studies and independent living (Ashraful et al., 2018; Shamsuddin et al., 2013). During the outbreak of COVID-19, the regular holiday activities of college students are limited as they have lost the freedom to go out and socialize face-to-face as they would usually (Chen et al., 2020). Irregularities in their daily life might lead to changes in the biological rhythms which was known as one of the important clinical characteristics and pathophysiological mechanism underlying mental illness (Monteleone et al., 2011).

A large-scale survey (44,447 respondents) conducted among university students during the COVID-19 pandemic in China reported that 12.2% (95%CI=11.9-12.5) of the respondents had been detected acquired the depressive symptoms and 7.7% were detected acquired anxiety symptoms (Wang et al., 2020). Although this study was conducted in a large scale, all the data in this online survey was collected through online questionnaire and not been tested its reliability and validity (Wang et al., 2020). In other web-based cross-sectional survey conducted among university students living in Bangladesh reported that more than two-thirds of the students were experiencing mild to severe depression (82.4%) and anxiety (87.7%) during the COVID-19 pandemic (Akhtarul Islam et al., 2020). The depression was measured by using the PHQ-9. Meanwhile, anxiety was measure by using Generalized Anxiety Disorder (GAD-7) Messenger (Akhtarul Islam et al., 2020). The respondents were obtained from the snowball sampling technique where

the participants were asked to share the online questionnaire with their friends using their personal and institutional Facebook and Messenger (Akhtarul Islam et al., 2020).

Besides, a study conducted in University of Cyprus found that 48.1% showed mild depression score, meanwhile 9.2% of the respondents showed moderate to severe depression score (Solomou & Constantinidou, 2020). For the anxiety, 41% were found had mild anxiety and 23.1% found had moderate to severe anxiety score (Solomou & Constantinidou, 2020). This study was included all students, faculties and staffs in the university (Solomou & Constantinidou, 2020). The effect of other key of demographic on depression and anxiety was tested using the Mann-Whitney test and Kruskal-Wallis tests. The result showed that the depression and anxiety score was higher among students (Median= 7.00) compared to non-students (Median= 5.00), where U=211695, $p<0.001$ and U=253586, $p<0.001$ respectively (Solomou & Constantinidou, 2020). Higher depression and anxiety score were associated with student status where bachelor students recorded the higher anxiety and depression score compared to PhD students (Solomou & Constantinidou, 2020). This study shows that undergraduate students were more likely to acquire anxiety and depression compared to postgraduate students.

2.2.1 Table of summary for mental health among university students

Table 2.2 showed the summary from previous study for the mental health among university students.

Table 2.2: Summary for mental health among university students

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	Factors associated with depression among university students in Malaysia: A cross-sectional study Ashraful. et al. 2018	• Cross-sectional study • 1023 university students, 1017 validated (two-stage stratified sampling) • target population: Undergraduate students from University of Malaya • Instrument Centre of Epidemiological Studies short Depression scale (CESD-10)	• University students are a special group of people in critical transition from adolescence to adulthood and one of the most stressful moments in a person's life • It is significant to study on their depression problem because of their potential role in society, as well as in the country • Depression, anxiety and stress causes mental health problem among young group especially university students that resulted from the studies and independent living
2.	Mental health status and change in living rhythms among college students in China during the COVID-19 pandemic: A large scale survey Chen et al. 2020	• Cross sectional survey among 361,969 college students • Variables: – living rhythms- time spent focusing on information about COVID-19 – sleeping rhythm – diet habit – exercise habit	• The regular holiday activities of college students are limited as they have lost the freedom to go out and socialize face-to-face as they would usually

		• Instruments: – 9-items Patient Health Questionnaire(PHQ-9) – RESE scale-assessed perceived self-efficacy in managing negative and expressing positive affect	
3.	Prevalence of anxiety and depression symptom and the demands for psychological knowledge and interventions in college students during COVID-19 epidemic: A large cross-sectional study Wang et al. 2020	• Large cross sectional online survey among 44,447 university students • Instruments: – Self-rating Anxiety Scale (SAS) for anxiety – Centre of Epidemiological Studies Depression scale (CESD) for depression	• The prevalence of – depression symptom 12.2% (95%CI=11.912.5) – anxiety symptom 7.7% (95% CI=7.5-8.0)
4.	Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey Akhtarul Islam et al. 2020	• Cross-sectional web-based survey • 476 university students living in Bangladesh • Instruments – 9-items Patient Health Questionnaire (PHQ-9) – 7-itemsGeneralized Anxiety Disorder (GAD-7)	• Experiencing mild to severe depression during the COVID-19 pandemic – 82.4% for depression – 87.7% for anxiety

5.	Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measure: age and sex matter Solomou & Constantinidou 2020	• Mixed sampling random & snowball sampling • Survey conducted online • Instruments: – Precautionary measure (PM) – Quality of Life (QOL) – Patient Health Instruments • 1642 participants – 10.8% were in Greece – 4.7%in European countries – 0.6% in North America	• Depression score, – 48.1% reported mild depression score – 9.2% reported moderate to severe depression score • Anxiety score, – 41% reported mild anxiety – 23.1% reported moderate to severe anxiety score • Depression and anxiety score was greater for students (Median= 7.00) than for non-students (Median = 5.00), where U=211695, $p< 0.001$ and U=253586, $p<0.001$ respectively • Higher depression and anxiety score were associated with student status – Bachelor students recorded the higher anxiety and depression score compared to PhD students

2.3 Sociodemographic Characteristics with Mental Health

In the aspect of demographic, a study found that younger respondents ($p \leq 0.002$), women ($p \leq 0.005$), and respondents from lower income family ($p \leq 0.003$) were significantly to report positive for depression and anxiety symptoms (Sherman et al., 2020). Those who unmarried or living with a partner ($p=0.002$) were significantly to show clinically increased levels of depressive symptoms (Sherman et al., 2020). The significant demographic variables were controlled and showed that a bigger chances to screen positive for depressive symptoms was correlated with being single (OR=0.48 ., 95% CI:.28-.83, $p=0.008$) (Sherman et al., 2020).

Solomou and Constantinidou (2020) reported that the depression and anxiety score were higher in women than men where Mann-Whitney test showed U=229337, $p<0.001$ and U=193370, $p<0.001$ respectively. Different age groups showed statistically significant difference in depression and anxiety scores (Solomou & Constantinidou, 2020). According to the Kruskal–Wallis H test, the youngest group were found had the highest depression [H(4)=148.96, $p<0.001$] and anxiety [H(4)=49.671, $p<0.001$] scores (Solomou & Constantinidou, 2020). Meanwhile, Wang et al. (2020) found that male gender was significantly associated with depression (B=0.12, 95% CI=0.01- 0.23), anxiety (B=0.19, 95% CI=0.05-0.33) and stress (B=0.10, 95% CI=0.02-0.19). Other sociodemographic variables including age, parental status, marital status, and household size were not associated with DASS subscale scores (Wang et al., 2020). The respondents from this study were obtained from the snowballing sampling strategy where the study population did not reflect the actual pattern of the general population (Wang et al., 2020).

Similarly, Akhtarul Islam et al. (2020) found depressive symptoms were higher in male (67.35%) compared to female (32.65%), whereas depressive

symptoms also were found higher among students in the early twenties (66.07%) than other age groups. Meanwhile, Liu et al. (2020) found that depression, anxiety, or post-traumatic sleep disorder (PTSD) had no association with age and income. As for gender, men who identified as transgender were more likely to report high levels of post-traumatic sleep disorder (PTSD) (OR=4.20, 95% CI=1.62 – 10.89, p=0.003) and there was no differences were observed between men and women (Liu et al., 2020). When comparing to Whites, Asian Americans were less likely to report high levels of depression (OR=0.50, 95%CI=0.33 – 0.76, p=0.001) and post-traumatic sleep disorder (PTSD) (OR=0.40, 95% CI = 0.25 – 0.64, p<0.001) (Liu et al., 2020). High levels of anxiety also been less likely to be reported among Asian Americans (OR=0.35, 95% CI=0.24 to 0.53, p<0.001) and Hispanic/Latinos (OR=0.35, 95% CI=0.18 to 0.68, p<0.001) (Liu et al., 2020).

A study in Malaysia found that gender [x^2(df=1,385)=7.468, p=0.006] and race [x^2(df=1,385)=4.683, p=0.030] were significantly associated with depression (Latiff et al., 2014). There were no significant associations between age, course and family monthly income with depression (Latiff et al., 2014). For anxiety subscale, race [x^2(df=1,385)=6.497, p=0.011] and course [x^2(df=1,385)=5.433, p=0.020] were associated with anxiety but not for age, gender and family monthly income (Latiff et al., 2014). On the other hand, stress was related with race [x^2(df=1,385)=12.783, p=0.001] and no significant associations with age, gender, course and family income (Latiff et al., 2014). This study was only limited to the first year students and there was bias in the population selection (Latiff et al., 2014).

2.3.1 Table of summary for sociodemographic with mental health

Table 2.3 showed the summary from previous study for the association between sociodemographic characteristics with mental health

Table 2.3: Summary for sociodemographic characteristics with mental health

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	Mental health outcome associated with the COVID-19 pandemic: Prevalence and risk factors in a southern US state Sherman et al. 2020	• Cross-sectional registry-based observational study (online survey) • 591/1672 respondents completed survey • Instruments – 9-items Patient Health Questionnaire (PHQ-9) – 7-items Generalized Anxiety Disorder (GAD-7) – 20-items PTSD checklist for DSM-5 (PCL-5) – 7-items AUDIT-C(alcohol usage)	• Significantly more likely to screen positive for depression anxiety symptoms – younger individuals ($p \leq 0.0002$) – women ($p \leq 0.005$) – lower income family ($p \leq 0.003$) – prior history of mental health diagnoses ($p \leq 0.0001$) • Significantly more likely to report clinically increased levels symptoms of depression and anxiety symptoms – Individuals with a greater number of medical comorbidities ($p=0.005$) – less education ($p=0.005$) – unmarried or living with a partner ($p=0.002$) – Individuals experiencing food insecurity ($p \leq 0.0001$) – financial insecurity ($p \leq 0.0001$) – reduced access to routine medical care ($p \leq 0.002$) – symptoms they ascribed to COVID-19 ($p \leq 0.0004$) – lack of daily structure ($p \leq 0.006$)

			• After controlling for significant demographic variables, a greater likelihood of screening positive for depressive symptoms was associated with: – prior history of mental health difficulties (OR=4.35, 95% CI=2.57-7.36, p<0.0001) – single (OR=0.48 ., 95% CI=0.28-0.83, p=0.008) – experiencing greater disruption in daily life due to the pandemic (OR=1.21 95% CI=1.12-1.30; p<0.001)
2.	Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measure: age and sex matter Solomou & Constantinidou 2020	• Mixed sampling random & snowball sampling • Survey conducted online • Instruments: – precautionary measure (PM) – QOL – Patient Health Instruments – • 1642 participants – 10.8% were in Greece – 4.7%in European countries – 0.6% in North America	• Mann-Whitney test • PHQ high in women (Median=6.00) than men (Median=4.00), U=229337, p<0.001 • GAD high in women (Median=6.00) than men (Median=4.00), U=193370, p<0.001 • PHQ score greater for students (Median=7.00) than non-students (Median=5.00), U=211695, p<0.001 • GAD greater for students (Median=7.00) than non-students (Median=5.00), U=254586, p<0.001 • Kruskal-Wallis H test – youngest group reported highest depression (H(4)=148.96, p<0.001) and anxiety score (H(4)=49.671,p<0.001)

3.	Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the general population in China Wang et al. 2020	• Online survey using snowball sampling techniques. • 1210 respondents from 194 cities in China • Instruments – Impact of Event Scale-Revised (IES-R) for psychological impact – Depression, Anxiety and Stress Scale (DASS-21) for mental health status	• Male gender was significantly associated with higher scores in DASS depression subscale (B=0.12, 95% CI=0.01-0.23), anxiety (B=0.19, 95% CI=0.05-0.33) and stress (B=0.10, 95% CI=0.02-0.19). • Other sociodemographic variables including age, parental status, marital status, and household size were not associated with DASS subscale scores
4.	Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey Akhtarul Islam et al. 2020	• Cross-sectional web-based survey • 476 university students living in Bangladesh • Instruments – 9-items Patient Health Questionnaire (PHQ-9) – 7-items Generalized Anxiety Disorder (GAD-7)	• Male (67.35%) had higher depressive symptoms than the female (32.65%) • Students in the early twenties (66.07%) showed higher depressive symptoms than other age groups.
5.	Factors associated with depression, anxiety and PTSD symptomatology during the COVID-19 pandemic: Clinical implications for U.S. young	• Cross-sectional online study • 898 respondents of US population • Instruments	• Not associated with depression – Age – Income • Gender, – men who identified as transgender had high

	adult mental health Liu et al. 2020	– 8-items Patient Health Questionnaire (PHQ-8) – 7-items Generalized Anxiety Disorder (GAD-7) – PTSD Checklist—Civilian Version (PCL-C)	levels of PTSD (OR=4.20, 95%CI=1.62-10.89, p=0.003) – no differences were observed between men and women • Ethnicity, comparing to Whites, – Asian Americans had high levels of depression (OR=0.50, 95% CI=0.33–0.76, p=0.001) and PTSD (OR=0.40, 95% CI=0.25 – 0.64, p<0.001) – High levels of anxiety also been less likely to be reported among Asian Americans (OR=0.35, 95% CI=0.24-0.53, p<0.001) and Hispanic/Latinos (OR=0.35, 95% CI=0.18-0.68, p<0.001)
6.	Prevalence of mental health problems and the associated factors among undergraduate students in a public university, Malaysia Latiff et al. 2014	• Cross-sectional study • Students aged 19-25 years old • Stratified sampling from randomly selected faculties • Instruments – Depression Anxiety Stress Scale (DASS-21) – Body Shape Questionnaire-8C (BSQ-8C) • 385/481 completed questionnaire (80%	• Significantly associated with **depression** – Gender [x^2(df=1,385)=7.468, p=0.006] – Race [x^2(df=1,385)=4.683, p=0.030] • No significant associations with depression – Age – Course – Family monthly income • Significantly associated with **anxiety** – Race [x^2(df=1,385)=6.497, p=0.011] – Course [x^2(df=1,385)=5.433, p=0.020] • No significant associations with anxiety – Age – Gender

		response rate)	– Family monthly income – BMI • Significantly associated with stress – Race [x^2(df=1,385)=12.783, p<0.001] • No significant association with stress – Age – Gender – Course – Family monthly income

2.4 Body Mass Index with Mental Health

Body mass index (BMI) is measured by the weight (kg) over square of height (m^2). A study showed that BMI was correlated with depressive symptom in men and female who had obesity problem, r=0.115, p<0.001 and r=0.048, p<0.001 respectively (Weinberger et al., 2018). The correlation value showed that higher BMI and more depressive symptoms was found a significant relationship in men (Weinberger et al., 2018). In the current sample, appearance evaluation mediated the association of BMI and depressive symptoms in men (b=0.134, SE=0.046, p=0.004) (Weinberger et al., 2018). While no direct effect (b=0.064, SE=0.045, p=0.160) of BMI on depressive symptoms in men was observed, the boot- strapped unstandardized indirect effect was significant at 0.070 (SE=0.018, 95% CI=0.040-0.110) (Weinberger et al., 2018).

Tashakori et al. (2016) found a significant relationship between obesity and the degree of depression in female adolescents. A Pearson correlation test was used and a positive and significant relationship was observed between BMI and the degree of depression (r=0.555, p< 0.001) (Tashakori et al., 2016). This study was conducted among the high school girls in Ahvaz which involved 400 participants. The assessment of depression was determined by the self-reported Beck Depression Inventory (BDI) and the body weight and height were measured by the researchers (Tashakori et al., 2016).

In Malaysia, a study found that body weight status had significant relationship with anxiety and stress (Mokhtari et al., 2015; Radzi et al., 2019). From the findings, Mokhtari et al., (2015) suggested that participants with lower level of anxiety scores were more likely to have high BMI scores because the finding showed a significant but negative relationship between anxiety and BMI (r=–0.152, p<0.05).

Furthermore, there was no significant relationship between depression and BMI (r=-0.084, p>0.05) (Mokhtari et al., 2015). In contrast, a study conducted in among university students in Malaysia showed no significant associations between BMI with depression, anxiety and stress (Latiff et al., 2014).

2.4.1 Table of summary for BMI with mental health

Table 2.4 showed the summary from previous study for the association between BMI with mental health.

Table 2.4: Summary for BMI with mental health

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	The relationship between weight status and depressive symptoms in a population sample with obesity: The mediating role of appearance evaluation Weinberger et al. 2018	• 1,000 participants with a self-reported BMI greater than 30 kg/m2 were interviewed • Instruments – 9-item Patient Health Questionnaire (PHQ-9) – Multidimensional Body-Self Relations Instruments-Appearance Scales (MBSRQ-AS)	• BMI was correlated with depressive symptom in men and female who had obesity problem, r=0.115, p<0.001 and r=0.048, p<0.001 • Appearance evaluation mediated the association of BMI and depressive symptoms in men (b=0.134, SE=0.046, p= 0.004) • No direct effect (b=0.064, SE=0.045, p= 0.160) of BMI on depressive symptoms in men • The boot- strapped unstandardized indirect effect was significant at 0.070 (SE=0.018, 95% CI=0.040-0.110)
2.	The relationship between body mass index and depression among high school girls in Ahvaz Tashakori et al. 2016	• Descriptive analytical study • Use stratified random sampling • Instruments – Depression use Beck Depression Instruments (BDS) • 400 female students	• The relationship between BMI and depression among high school students is positive and significant (r=0.555, p<0.001)

3.	Lifestyle and psychological factors associated with body weight status among university students in Malaysia Mokhtari et al 2015	• Cross-sectional study • 310 respondents (Iranian students) • Instruments – Global Physical Activity Instruments (GPAQ) for lifestyle factors – Food record for dietary assessments – Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI) for psychological factors • Anthropometric measurements	• Relationship between BMI and anxiety – Negative significant relationship (r= -0.152, p<0.05) – Suggested that participants with lower levels of anxiety had higher BMI score • No statistically significant relationship between BMI and depression (r= -0.084, p>0.05)
4.	Prevalence of mental health problems and the associated factors among undergraduate students in a public university, Malaysia Latiff et al. 2014	• Cross-sectional study • Students aged 19-25 years old • Stratified sampling from randomly selected faculties • Instruments – Depression Anxiety Stress Scale (DASS-21) – Body Shape Questionnaire-8C (BSQ-8C)	• No associations between BMI with depression, anxiety and stress

2.5 Body Image Perception with Mental health

Latiff et al. (2014) found that there were significant association between mild to severe concern of body image with depression, anxiety and stress among university students in Malaysia. Similarly, Edman et al. (2014) found that body dissatisfaction was also positively associated with depression scores for both males [$r(332)=0.350$; $p<0.001$] and females [$r(538)=0.245$; $p<0.001$].

A comparison study between pre- and post-treatment for clinical group of depressed patient showed that there were correlations between the three dimensions of body experience and depression severity at pre-treatment for the whole group and for men and women separately (Scheffers et al., 2019). There were medium to strong associations between depression severity and body satisfaction were found before and after treatment, and when controlling for covariates (Scheffers et al., 2019). However, this study design did not permit causal interpretations regarding the relationship between body image disturbance and depression severity (Scheffers et al., 2019).

A Meta-analyses of Pearson correlation test found statistically significant associations between body satisfaction with depression (r=0.34, 95% CI=0.22-0.45) and anxiety (r= 0.40, 95% CI=0.28-0.51) (Barnes et al., 2020). This meta-analysis was collected from 23 cross-sectional studies and from them, 19 studies found statistically significant positive correlations between body dissatisfaction and anxiety and/or depression (Barnes et al., 2020). Barnes et al. (2020) suggested that men who experience higher body dissatisfaction were more likely to also report higher levels of anxiety and depression. In contrast, Weinberger et al. (2018) found that there was a negative association between satisfaction with appearance and depression was found in men (r=-0.305, $p<0.001$) and women (r=-0.274, $p<0.001$).

2.5.1 Table of summary body image perception with mental health

Table 2.5 showed the summary from previous study for the association between body image perception with mental health.

Table 2.5: Summary body image perception with mental health

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	Prevalence of mental health problems and the associated factors among undergraduate students in a public university, Malaysia Latiff et al. 2014	• Cross-sectional study • 385 students aged 19-25 years old • Stratified sampling from randomly selected faculties • Instruments – Depression, Anxiety Stress Scale (DASS-21) – Body Shape Questionnaire-8C(BSQ-8C)	• Significantly associated body image – depression [x^2 (df=3,385)=58.749, p<0.001] – anxiety [x^2 (df=3,385)=43.009, p<0.024] – stress [x^2 (df=3,385)=30.008, p<0.001]
2.	The impact of exercise performance dissatisfaction and physical exercise on symptoms of depression among college students: A gender comparison Edman et al. 2014	• 895 undergraduate university from six University of Hawai'i campuses • Instruments – Centre of Epidemiology Study for Depression (CESD) – Figure Rating Scale (FRS) – Self-Loathing Subscale (SSLS) of the Exercise Orientation Questionnaire	• Positive association with depression – Body dissatisfaction, males (r(332)=0.350,p<0.001) and females (r(538)=0.245,p<0.001)

3.	Body attitude, body satisfaction and body awareness in a clinical group of depressed patients: An observational study on the associations with depression severity and the influence of treatment Scheffers et al. 2019	• Department of Mood and Anxiety Disorders, University Center for Psychiatry (UCP), University Medical Center Groningen (UMCG), a tertiary academic centre. • 98 respondents • Instruments – Body attitude (Dresden Body Image Questionnaire) – body satisfaction (Body Cathexis Scale) – body awareness (Somatic Awareness Questionnaire) – severity of depressive symptoms (Inventory of Depressive Symptomatology)	• After treatment, depression scores decreased with: – Large effect sizes, scores for body attitude – body satisfaction increased with medium effect sizes – body awareness scores increased slightly. • Medium pre-treatment and strong post-treatment associations were found between depression severity and body attitude and between depression severity and body satisfaction. • The correlations of DBIQ (r=-0.38,p<0.05) and BCS(r=-0.28) with IDS are weak to moderate • The correlations of SAQ with IDS as well as with the other body experience measures are very weak
4.	Associations between body dissatisfaction and self-reported anxiety and depression in otherwise healthy men: A systematic review and meta-analysis Barnes et al.	• A systematic review was conducted using Preferred Reporting Items for Systematic Reviews and Meta Analyses as the reporting guideline.	• 23 cross-sectional studies were included in the review. • 19 studies found positive correlations between male body dissatisfaction and anxiety and/or depression • Meta-analyses of Pearson correlation coefficients found significant associations with

	2020		body satisfaction for depression (r=0.34, 95% CI=0.22-0.45) and anxiety (r=0.40, 95% CI=0.28-0.51) and both depression and anxiety outcomes (r=0.47, 95% CI=0.33-0.59) • Measures of body satisfaction focused predominantly on muscularity and thinness.
5.	The relationship between weight status and depressive symptoms in a population sample with obesity: The mediating role of appearance evaluation Weinberger et al. 2018	• 1,000 participants with a self-reported BMI greater than 30 kg/m2 were interviewed • Instruments – 9-items Patient Health Questionnaire (PHQ-9) – Multidimensional Body-Self Relations Instruments-Appearance Scales (MBSRQ-AS)	• Negative relationship – between satisfaction with appearance and depression was found in men and women.

2.6 Physical Activity with Mental Health

Akhtarul Islam et al. (2020) found that depression and anxiety were prevalent among students with no physical exercise with proportion 62.24% and 61.95% respectively. Similarly, crude model for the physical activity variable showed the odds to acquire depressive symptoms were lower for those who were physically active in a sports club (OR=0.40, 95% CI=0.30–0.53), in a sports club and gym (OR=0.40, 95% CI=0.28–0.56), in a sports club and exercising or keeping fit independently (OR=0.52, 95% CI=0.38–0.72) and in a sports club, gym and exercising or keeping fit independently (OR=0.58, 95% CI=0.41–0.81), compared to those who had irregular exercise (Kleppang et al., 2018).

A study among female college students showed a negative significant association between high physical activity and anxiety (r=-0.160, p=0.001) and depression (r=-0.118, p=0.01), meanwhile stress had low correlation with high physical activity (Pilipović-Spasojević et al., 2020). This finding showed that high physical activity had the effect in reducing anxiety and depression but had no effect on stress (Pilipović-Spasojević et al., 2020). Similarly, Al-Eisa et al. (2014) found a negative significant association between physical activity and depression (r=-0.78). Besides, this study found that exercise for 3 weeks could improve the depression score and this finding indicated that increased in physical activity can reduce depression (t=10.22, $p\leq0.05$) (Al-Eisa et al., 2014).

Physical exercise was negatively associated with depression among males. Among males, exercise frequency [$r(332)=-0.255$, $p<0.001$], exercise regularity [$r(331)=-0.296$, $p<0.001$], exercise intensity [$r(330)=-0.180$, $p<0.001$] and hours exercised [$r(325)=-0.174$, $p<0.001$] were significant negatively correlated with the

depression scores (Edman et al., 2014). On the other hand, Deepthi et al. (2015) found that students who physically active were less likely to acquire depression and anxiety compares to physically inactive students. This study was done among undergraduate medical students and intern of a medical college of rural Karnataka, India which involved 430 students who participated in this study (Deepthi et al., 2015).

2.6.1 Table of summary for physical activity with mental health

Table 2.6 showed the summary from previous study for the association between physical activity with mental health.

Table 2.6: Summary for physical activity with mental health

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey Akhtarul Islam et al. 2020	• Cross-sectional web-based survey • 476 university students living in Bangladesh • Instruments – 9-items Patient Health Questionnaire (PHQ-9)	• Depression was prevalent among students with no physical exercise (62.24%) • Anxiety was prevalent among students with no physical exercise (61.95%)
2.	The association between physical activity and symptoms of depression in different contexts- a cross sectional study of Norwegian adolescents Kleppang et al. 2018	• self-reported cross-sectional study • Instruments – Hopkins Symptom Checklist	• Depressive symptoms found in – Physical activity less than 3 times/ week, a higher percentage reported depressive symptoms compared with students fulfilling more than 3 times/week. – Adolescents who exercised or competed in a sports club less than once a week reported more depressive symptoms compared to those who reported 1 or more times per week.
3.	Correlation of physical activity with stress, depression and	• Obseravational study of 408 healthy female students aged 19 to 22 years from	• A significant negative correlation found between

	anxiety in female students Pilipović-Spasojević et al. 2020	University of Banja Luka • Instruments – Depression Anxiety Stress Scale (DASS-21) – International Physical Activity Questionnaire (IPAQ long version) – BMI measurement	– High PA and anxiety (r=–0.160, p=0.001), – High PA and depression (r=–0.118, p=0.01) • Stress had a low correlation with PA. • High level of PA has no effect on stress but has an effect on reducing anxiety and depression.
4.	Association between physical activity and psychological status among Saudi female students Al-Eisa et al. 2014	• Cross-sectional study • • 66 female Saudi students, of mean age 20.9 ± 1.4 years • Instruments – Attention (AST) – Insomnia Severity Scale (ISI) – Beck Depression Inventory (BDI)	• Physical activity was negatively correlated with insomnia (r=–0.74) and depression (r= –0.78) • Physical activity was positively correlated with AST (r=0.69) • Exercise for 3 weeks improved ISI and BDI scores
5.	The impact of exercise performance dissatisfaction and physical exercise on symptoms of depression among college students: A gender comparison Edman et al. 2014	• 895 undergraduate university from six University of Hawai'i campuses • Instruments – CESD – Figure Rating Scale (FRS) – Self-Loathing Subscale (SSLS) of the Exercise Orientation Questionnaire	• Negative association with depression – Physical exercise (exercise frequency [r(332) =−0.255, p<0.001] – Exercise regularity [r(331)=−0.296, p<0.001] – Exercise intensity [r(330)=–0.180,p<0.001] – Hours exercised [r(325)=–0.174, p<0.00] among males but no significant association between CESD among females

6.	Good mental health status of medical students: Is there a role for physical activity? Deepthi et al. 2015	• Cross-sectional study done among 430 medical students and interns of medical college in rural Karnataka, India • Instruments – International Physical Activity Questionnaire (IPAQ) – Hospital Anxiety and Depression Scale (HADS)	• Students who were highly active and minimally active in physical activity showed lower level of depression and anxiety compared to low physical activity group • Students who engaged in some physical activity were significantly less depressed (34.1%) as compared to students who were physically inactive (49.9%) • Anxiety among physically inactive students was 66.9%, which is slightly higher as compared to students who were physically active (64.1%) • Students engaging in physical activity were significantly less likely to be suffering from depression and anxiety (31.2%) as compared to students who were physically inactive (40.3%)

2.7 Sleep Quality with Mental Health

Poor sleep quality among nursing students was closely associated with depressive symptoms where poor sleep quality was positively correlated with depressive symptoms (r_s=0.59, p<0.01) (Zhang et al., 2018). In this study, the instruments used to assess the sleep quality and depressive symptoms were Pittsburgh Sleep Quality Index (PSQI) and Center for Epidemiological Studies Depression (CESD) (Zhang et al., 2018). In other study used the same instrument to assess sleep quality also reported that PSQI global score was positively associated with scores for depression (r_s=0.35, p< 0.001 and r_s= 0.35, p< .001) (Zou et al., 2020).

According to Ashraful et al. (2018) students with mild, moderate, and severe sleeping problem were 2.50 times (95% CI=1.61-3.88), 3.34 times (95% CI=2.18-5.11), and 3.66 times (95% CI=1. 93 -6. 94) more likely to be depressed than those without sleeping problem, respectively (Ashraful et al., 2018). The depressive symptom was assessed by using the CESD-10, a short form version of questionnaire for CESD. However, this study did not mention the instrument used to measure the sleeping problem.

Among men, infrequent nights of restful sleep were associated with depressive symptoms [x^2(df=1,1552)=21.91, p<0.001]. Similarly, among women, infrequent nights of restful sleep were associated with depressive symptoms, [x^2(df=1,2132)=48.67, p<0.001] (Rosso et al., 2020). Sleep was measured by using one item from the National College Health Assessment (NCHA) with category frequent (≥4 nights/week) or infrequent (≤4 nights/week) nights of restful sleep. Meanwhile, depression was assessed by using the Patient Health Questionnaire-2 (PHQ-2), which assessed the frequency participants felt “little interest or pleasure in

doing things" or "feeling down, depressed, or hopeless" in the past two weeks on a four-point scale ranging from zero ("not at all") to three ("nearly every day"). A summed score of responses ≥3 has shown good sensitivity and specificity. Similarly, Chen et al. (2020) found that irregular bedtime (OR=1.58, 95% CI=1.43–1.73, p<0.001) was one of the risk factors for depressive symptoms during the COVID-19 pandemic. This study was focusing on the depressive symptom and changes in living rhythms among China population during the COVID-19 pandemic and sleep was one of the components in living rhythm (Chen et al., 2020). The sleeping rhythm was assessed by answering two questions which were average daily time waking up for the past two weeks and average daily time going to sleep (Chen et al., 2020).

Poor sleep quality was found statistically significant with depression anxiety and stress among undergraduate students in Southern Thailand which men were classified as poor sleepers compared to women (Pensuksan et al., 2016). The Pearson correlation test showed that Pittsburgh Sleep Quality Index (PSQI) score was significantly associated with mental health problems (r=0.36, p<0.001) which the level of depression (r=0.34, p<0.001), anxiety (r=0.35, p<0.001) and stress (r=0.38, p<0.001) (Pensuksan et al., 2016). This finding indicated that the higher global PSQI score was associated with higher depression, anxiety and stress symptoms (Pensuksan et al., 2016)

2.7.1 Table of summary for sleep quality with mental health

Table 2.7 showed the summary from previous study for the association between sleep quality with mental health

Table 2.7: Summary for sleep quality with mental health

No.	Title/authors/year	Setting/no. of subjects/instruments	Findings
1.	Relationships among sleep quality, coping styles, and depressive symptoms among college nursing students: A multiple mediator model Zhang et al. 2018	• 242 undergraduate nursing students at a public university in the northeast United States • Instruments – Depression measured using CESD – sleep quality use PSQI – Coping Strategies Inventory Short Form (CSI-SF)-32 items	• Significantly associated with depression – Poor sleep quality (β=1.00, p<0.01)
2.	Poor sleep quality correlated with mental health problems in college students: A longitudinal observational study among 686 males	• A longitudinal observational study among 686 male college students • Instruments: – Depression Anxiety Stress Scale (DASS-21) – Pittsburgh Sleep Quality Index (PSQI)	• PSQI global score was positively associated with scores for – Depression in 2014 (r_s=0.35, p<0.001) and 2015 (r_s =0.35, p<0.001) – Anxiety in 2014 (r_s=0.38, p<0.001) and 2015 (r_s=0.36, p<0.001) – Stress in 2014 (r_s=0.45, p<0.001) and 2015 (r_s=0.47, p<0.001)
3.	Factors associated with depression among university students in Malaysia: A cross-sectional study	• Cross-sectional study • 1023 university students, 1017 validated	• Mild 2.50 times (95% CI=1.61-3.88), moderate 3.34 times (95% CI=2.18-5.11), severe 3.66 times (95% CI=1. 93 -6. 94) sleeping problem

	Ashraful et al. 2018	(two-stage stratified sampling) • target population: Undergraduate students from University of Malaya • Instrument CESD-10 (centre of epidemiological studies short depression scale)	more likely to be depressed than without sleeping problem
4.	Frequent restful sleep is associated with the absence of depressive symptoms and higher grade point average among college students Rosso et al 2020	• Cross-sectional study, online survey • • 4376 college students from North-eastern United State university • Instruments – FVC (fruit & vegetable consumption) – Patient Health Questionnaire-2 (PHQ-2) – Sociodemographics – BMI, PA	• positive association with the absence of depressive symptoms – frequent restful sleep (nonparametric analyses) • associated with depression symptoms – Among men, infrequent nights of restful [x^2(df=1,1552)=21.91, p<0.001] – among women, infrequent nights of restful sleep [x^2(df=1, 2132)=48.67, p<0.001]
5.	Mental health status and change in living rhythms among college students in China during the COVID-19 pandemic: A large scale survey Chen et al. 2020	• Cross sectional survey • Instruments – Patient Health Questionnaire-9 (PHQ-9) – RESE scale-assessed perceived self-efficacy in managing negative and expressing positive affect	• Significantly associated with depressive symptoms – wake time – sleep time • Risk factors for depressive symptoms – sleeping times later than 24:00 bedtimes (OR=1.53, 95% CI=1.39–1.68, p<0.001)

		• 361,969 college students completed the questionnaire	– irregular bedtime (OR=1.58, 95% CI=1.43–1.73, p<0.001)
6.	Relationship between poor sleep quality and psychological problems among undergraduate students in the Southern Thailand Pensuksan et al. 2016	• Cross-sectional study • 1130 undergraduate students • Instruments – The Pittsburgh Sleep Quality Index (PSQI) – The Epworth Sleepiness Scale (ESS) – The Depression, Anxiety and Stress Scale (DASS 21) – Thai General Health Questionnaire (Thai GHQ-12)	• Poor sleep quality was statistically significant associated with symptoms of depression, anxiety and stress • The PSQI score was significantly associated with – daytime sleepiness (r=0.17, p<0.001), mental health problems (r=0.36, p<0.001) – the level of symptoms of depression (r=0.34, p<0.001), anxiety (r=0.35, p<0.001) and stress (r=0.38, p<0.001) indicating progressively worse global sleep quality associated with higher levels of daytime sleepiness and higher symptomatology of mood and anxiety disorders

CHAPTER 3

METHODOLOGY

3.1 Study Design

This was a virtual cross-sectional study aimed to determine the associations between sociodemographic, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic.

3.2 Study Location

This study was conducted at Universiti Putra Malaysia, Serdang, Selangor. Universiti Putra Malaysia comprised of 14 faculties include, Faculty of Agriculture, Faculty of Forestry and Environment, Faculty of Veterinary Medicine, Faculty of Medicine and Health Sciences, Faculty of Human Ecology, Faculty of Economics and Management, Faculty of Engineering, Faculty of Food Science and Technology, Faculty of Educational Studies, Faculty of Science, Faculty of Design and Architecture, Faculty of Modern Languages and Communication, Faculty of Computer Science and Information Technology and Faculty of Biotechnology and Biomolecular. This study involved undergraduate students from Universiti Putra Malaysia. However, due to the COVID19 pandemic this study was conducted through online survey. The survey was created using Google Form and distributed to the respondents through social media such as *WhatsApp*.

3.3 Sample Size

Table 3.1 shown the sample size formula for correlation study was used to calculate the sample size of the study:

$$n = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2}{r^2/(1-r^2)} + 5$$

Where,

n=the calculated sample size

$z_{1-\alpha/2=}$ z score for level of significance a in two sided test = 1.96

$z_{1-\beta}$ = z score for power of the test = 0.84

r = correlation

(Cole, 1997)

Table 3.1: Sample size calculation for each variable based on the previous studies in the correlations between depression and its associated factors

Variables	r value	Sample size, n
Correlation between body mass index with depression among female (Tashakori et al., 2016)	r = 0.55	$n = \frac{(1.96 + 0.84)^2}{0.43^2/(1-0.43^2)} + 5$ n = 24
Correlation between body dissatisfaction with depression (Barnes et al., 2020)	r = 0.35	$n = \frac{(1.96 + 0.84)^2}{0.44^2/(1-0.44^2)} + 5$ n = 62
Correlation between recreational exercise with depression (Weinstein et al., 2015)	r = 0.311	$n = \frac{(1.96 + 0.84)^2}{0.311^2/(1-0.311^2)} + 5$ n = 79
Correlation between poor sleep quality with depression (Pensuksan et al., 2016)	r = 0.339	$n = \frac{(1.96 + 0.84)^2}{0.339^2/(1-0.339^2)} + 5$ n = 66

The highest number of sample size was selected as the final sample size of the study, which were 79 respondents based on Table 3.1. Additional adjustment in computing the sample size was conducted as shown in Table 3.2 in order to obtain the required sample size of this study.

Table 3.2: Additional adjustment in sampling the sample size

Criteria	Adjustments	Sample size, n
Adjust for the estimated sample effect	**nadj * DEFF** DEFF = 1.3 (Aday & Cornelius, 2006)	n = 79 x 1.3 n = 102.7
Adjust for the expected response rate	**nadj/ Response rate** Response rate = .94 (Ashraful et al., 2018)	n = 102.7/ .80 n = 109.3
Adjust for the expected proportion eligible	**nadj/ Proportion eligible** % Eligible = .90	n = 109.3/.90 n = 121.4 ~ 121

After consideration of design effect, response rate and expected proportion of eligibility, the final sample size required for this study was 121 respondents.

3.4 Respondents

The target population for this study was university students in Universiti Putra Malaysia, Serdang, Selangor. Respondents were selected based on the inclusion and exclusion criteria as stated in Table 3.3.

Table 3.3: Inclusion and exclusion criteria for the selection of respondents

Inclusion criteria	Exclusion criteria
Male and female Undergraduate students 18-25 years old	International students

3.5 Sampling Design

In this study, a multistage sampling design was adopted for the selection of respondents as shown Figure 3.1. This study was conducted in UPM Serdang. There were 14 faculties (Faculty of Agriculture, Faculty of Forestry and Environment, Faculty of Veterinary Medicine, Faculty of Medicine and Health Sciences, Faculty of Human Ecology, Faculty of Economics and Management, Faculty of Engineering, Faculty of Food Science and Technology, Faculty of Educational Studies, Faculty of Science, Faculty of Design and Architecture, Faculty of Modern Languages and Communication, Faculty of Computer Science and Information Technology and Faculty of Biotechnology and Biomolecular) in UPM Serdang with wide range of academic programmes.. These 14 faculties were divided into three categories which were Art and Social Sciences, Sciences and Technical. From these three categories, a simple random sampling was used to randomly pick one faculty from each category. Then, a bachelor programme was randomly picked from the selected faculty. All students from the selected bachelor programme were clustered by year of studies. About 13 undergraduate students from each year based on the selected programme were recruited as the respondents and were included in the respective *WhatsApp* group. Overall, there were 164 students were invited to participate in this study. However, there were several respondents who refused to participate in this study and it gave total valid number of respondents were 130 respondents.

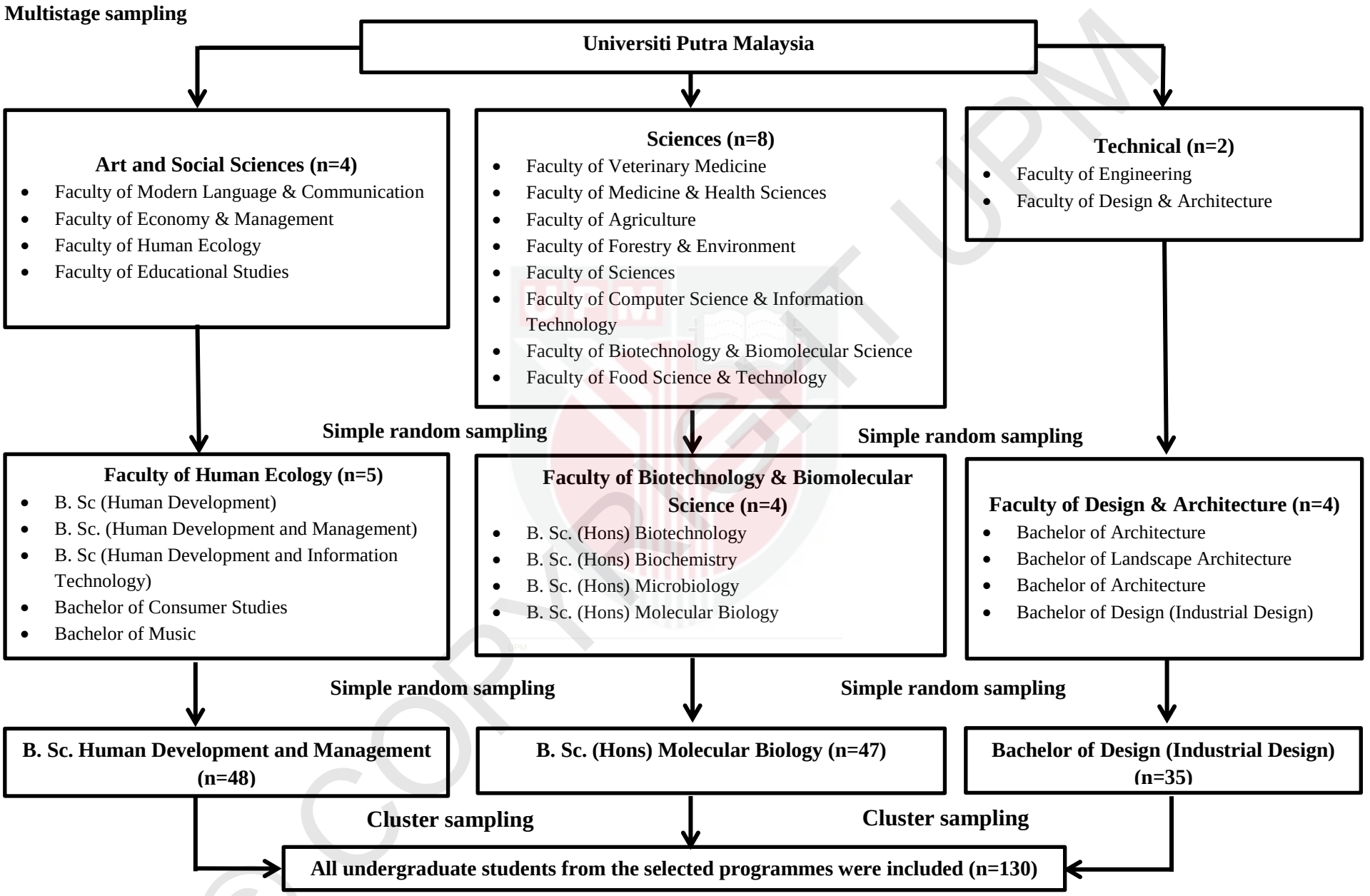

Figure 3.1: Sampling design of the study

3.6 Study Instruments

An English language self-administered questionnaire was used to collect data on sociodemographic, body mass index, body image perception, physical activity, sleep quality and mental health. As this study was conducted online through *GoogleForm* platform, the body mass index (body weight and height) were based on the self-reported by the respondents.

3.6.1 Section A: Sociodemographic Characteristics

This section contained the sociodemographic of the respondents which included age, gender, ethnicity, marital status, year of study, programme of study, faculty, monthly family income and location of stay during COVID-19 pandemic. All of these characteristics were self-reported by the respondents. Please refer to Appendix A in Section A for the sociodemographic characteristic items.

3.6.2 Section B: Body Mass Index

The weight (kg) and height (cm) of the respondents were based on the self-reported measurement. The weight and height were used to calculate the body mass index (BMI) by following the formula to calculate BMI as shown in Table 3.4. BMI was used to estimate the body fat and to screen the category of weight. After BMI have been calculated, the respondents were grouped into different body weight status categories based on the World Health Organization (1998) classification as shown in Table 3.4. Please refer to Appendix A in Section B for the weight and height items.

Table 3.4: Classification of Body Mass Index (BMI)

Body mass index (BMI): $\frac{weight\ (kg)}{hegiht\ (m^{2})}$

Body weight status	BMI (kg/m^2)
Underweight	<18.5
Normal weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity class I	30.0 – 34.9
Obesity class II	35.0 – 39.9
Obesity class III	≥ 40

3.6.3 Section C: Body Image Perception

A self-reported questionnaire, Body Shape Questionnaire-8C (BSQ-8C) was used to assess the body shape dissatisfaction for this study. BSQ-8C was a self-report scale and been widely used to assess body dissatisfaction that caused by feelings of being fat (Pook et al., 2008). BSQ-8C was a short version of BSQ-34 which been used as an "alternate form" to save time and cost. Each item was scored 1 to 6 with "never"=1 and "always"=6. The overall score was the sum of scores of the 8 items where a minimum of 8 and maximum of 48 were possible to be obtained (Evans & Dolan, 1993). Based on the total score, the respondents were classified into four categories regarding their severity of concern with body shape as shown in Table 3.5. Please refer to Appendix A in Section C for the 8-items Body Shape Questionnaire (BSQ-8C).

Table 3.5: Category of score for Body Shape Questionnaire-8 (BSQ-8) score

BSQ-8 score	Category of score
8-18	No concern
19-25	Mild concern
26-33	Moderate concern
34-48	Marked concern

(Dowson & Henderson, 2001)

3.6.4 Section D: Physical Activity

Physical activity was assessed by using Global Physical Activity Questionnaire version 2 (GPAQv2). GPAQ was developed by World Health Organization (WHO) and it was the modifiable version from the International Physical Activity Questionnaire (IPAQ) (Armstrong & Bull, 2006). Its validity and reliability had been proven over nine countries and was suitable to be used for monitoring physical activity in population health surveillance system (Bull et al., 2009). Good-to-very-good test-retest reliability was showed with the time interval ranged from two to three weeks (Herrmann et al., 2013).

GPAQ consisted of 16 items that asked the physical activity in typical week. The questions were divided into three domains which were activity at work, travel to and from places and recreational activities also sedentary behaviours (Global Physical Activity Questionnaire Analysis Guide Version-2). The score were in the MET-minutes/ week and from the score it was then categorised into three categories. Each of the domains contributed to the different METs value where the Mets value was applied according to the intensity of the activity. The calculation of MET-minutes/week and the METs value according to the domain was shown in Table 3.6. The categorisation for GPAQ followed the Global Physical Activity Questionnaire Analysis Guide Version-2. The categorisation was as defined in Table 3.7. Please refer to Appendix A in Section D for the items in Global Physical Activity Questionnaire (GPAQ).

Table 3.6: The calculation MET minutes/week and METs value for the three domains

$$\textbf{MET min} - \textbf{per week} = \textbf{MET value} \times \textbf{minutes per activity} \times \textbf{events per week}$$

Domain	Mets value
Work	Moderate MET value= 4.0 Vigorous MET value= 8.0
Transport	Cycling and walking MET value= 4.0
Recreation	Moderate MET value= 4.0 Vigorous MET value= 8.0

(Global Physical Activity Questionnaire Analysis Guide Version-2)

Table 3.7: The criteria for each of the categories of physical activity level

Categories	Criteria
Low	The value does not reach the criteria for either high or moderate levels of physical activity
Moderate	• 3 or more days of vigorous-intensity activity AND at least 60 MET-minutes/day OR • 5 or more days of moderate-intensity activity AND at least 150 MET-minutes/day OR • 5 or more days sum of moderate-intensity and vigorous-intensity activities AND at least 600 MET-minutes/week
High	• 3 or more days of vigorous-intensity activity AND at least 1500 MET-minutes/week OR • 7 or more days sum of moderate-intensity and vigorous-intensity activities AND at least 3000 MET-minutes/week

(Global Physical Activity Questionnaire Analysis Guide Version 2)

3.6.5 Section E: Sleep Quality

Sleep quality was assessed by using The Pittsburgh Sleep Quality Index (PSQI) developed and validated by Buysse et al. (1998). PSQI contained 18 items with 4 items were open-ended questions and 14 items rated with 4 Likert-scale. The 18 items assessed seven components of sleep quality during the past month including sleep quality, sleep latency, sleep duration, habitual sleep efficiency, step disturbances, use of sleeping medication and daytime dysfunction (Buysse et al., 1989). The 4 Likert-scale was rated with 0-3 where "0" indicates no difficulty, while a score of "3" indicates severe difficulty. The scores of seven components were summed to yield a PSQI global score ranging from 0 to 21. The categorization for PSQI global score was shown in Table 3.8. The original PSQI had an internal consistency of 0.83 (Buysse et al., 1989). PSQI also was used to assess sleep quality among university students and it was appropriate to be used for 18 years old and above (Pensuksan et al., 2016). Please refer to Appendix A in Section E for the items in Pittsburgh Sleep Quality Index (PSQI).

Table 3.8: Category for PSQI global score

PSQI Global Score	Category
0-5	Good sleeper
6-21	Poor sleeper

(Buysse et al., 1989)

3.6.6 Section F: Mental Health

Mental health was assessed by using the Depressive Anxiety Stress Scale-21 (DASS-21). This instrument was developed by Lovibond and Lovibond (1995). DASS-21 was used for this study because this instrument was easy and had been proven its validity and reliability among university students (Ahmad et al., 2018; Othman &

Rashid, 2018; Shamsuddin et al., 2013). The Cronbach's Alpha for this instrument showed the good reliability for anxiety (α=0.850), stress (α=0.859) and depression (α=0.910) (Ahmad et al., 2018). The overall score for the items also showed the positive consistency with Cronbach's Alpha (α=0.926) (Ahmad et al., 2018).

DASS-21 was the modified and short-form version of the original DASS-42 which assessed the negative emotional disturbance of individual (Lovibond & Lovibond, 1995). It was divided into three subscales included depression, anxiety and stress level. Each subscale contained 7 items with 4 Likert-scale where 0=Never, 1=Sometimes, 2=Often 3=Always. The 7 items from each subscale were summed up and multiplied by two to match the total score from the original 42 items for each subscale (Lovibond & Lovibond, 1995). The estimated total score for each subscale were 0-42. The subscales were categorised into its severity ratings as shown in Table 3.8. The total score for each subscale were then summed up to obtain the total score for DASS-21. According to Beaufort et al. (2017), the possible total score for DASS-21 were 0-120 with cut-off score ≥60 is considered severe and this cut=off score was proposed by Lovibond & Lovibond (1995). Please refer to Appendix A in Section F for the 21 items in Depression Anxiety Stress Scale (DASS-21).

Table 3.9: Severity rating for depression, anxiety and stress subscales

Severity ratings	Subscales		
	Depression	**Anxiety**	**Stress**
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely severe	≥28	≥20	≥34

(Lovibond & Lovibond, 1995)

3.7 Study Approval

Ethical approval was obtained from the Ethics Committee for Research Involving Human Subjects Universiti Putra Malaysia (JKEUPM) with reference number JKEUPM-2020-510 prior the data collection. A permission letter was obtained from the dean of the selected faculties prior to study commencement.

3.8 Data Collection

Data collection was conducted through online survey from April 2021 to May 2021. The respondents were given a link of *GoogleForm* to answer the online survey. In the *GoogleForm*, there were the information about the study and the consent form to be filled by the respondents prior the survey. The respondents were self-recorded their sociodemographic information and current body weight status. They were also self-rated the questionnaires on body image perception, physical activity, sleep quality and mental health. Each respondents required 10 to 15 minutes to fill the questionnaire.

3.9 Data Analysis

The data obtained was analysed by using IBM SPSS Statistics 25.0. Descriptive analysis was performed for both categorical and continuous variables. Categorical variables were reported in the form of frequency and percentage (age group, gender, ethnicity, marital status, year of study, programme of study, faculty, family monthly income, and location of stay during COVID-19 pandemic, BMI category, body image perception category, sleep quality category, physical activity category and mental health category). Meanwhile, BMI, body image perception score, physical activity score, sleep quality score and mental health score were reported in the form

of mean ± SD. A chi-square test of independence was conducted to analyse the categorical data. Meanwhile, for normal distribution continuous data included age, family monthly income, BMI, body image perception score, and sleep quality score were analysed its association with each subscale of mental health used Pearson correlation test. Spearman test was used to assess the association between physical activity total METs with mental health and its subscales. The p-value for all test was set at $p<0.05$.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Sociodemographic characteristics

The sociodemographic characteristics of the respondents were shown in Table 4.1. The total numbers of respondents obtained and follow the inclusion and exclusion criteria were 130. From the 130 respondents, 23.8% (n=31) were male and 76.2% (n=99) were female. The mean age for the respondents was 21.98 ± 1.16 years ranging from 18 to 25 years old. The majority was from age group 22-25 (66.9%) while other was from the other age group, 19-21(33.1%). Ethnicity of the respondents were mostly from Malay (78.5%), followed by Chinese (13.8%), Indian (6.2%) and others (1.5%). Others were from Sabahan. All of the respondents were single and majority were from the second year of study (28.5%). Second most year of study is third year (26.9%) followed by first year (26.2%) and fourth year (18.5%). The respondents were recruited from three different programme of study which was Bachelor of Science Human Development and Management (36.9%) from Faculty of Human Ecology, Bachelor of Science Molecular Biology (36.2%) from Faculty of Biotechnology and Molecular Science, and Bachelor of Design in Industrial Design (26.9%) from Faculty of Design and Architecture. Regarding family monthly income, most of the respondents were from low income family (59.2%) and few from high income family (10.0%). During the COVID-19 pandemic, 57.7% (n=75) of the respondents were stayed with their family (with

parents), 33.8% (n=44) were stayed at residential college and 8.5% (n=11) stayed at rental house (without parents).

Previous study found that majority of the respondents were female, Malays and lived with their family during the COVID-19 pandemic (Sundarasen et al., 2020). Several studies also showed that female respondents were major in their samples compared to male (Chen et al., 2020; Ma et al., 2020; Naser et al., 2020; Tang et al., 2020; Z. H. Wang et al., 2020; Wathelet et al., 2020). Mohamad et al. (2021) found most of the respondents were from low income family. Few studies showed that majority of their respondents lived with family during the COVID-19 pandemic (Akhtarul Islam et al., 2020; Tang et al., 2020). Previous studies were consistent with current study where majority of the respondents were female, Malays, from low income family and stay with family during the COVID-19 pandemic.

Table 4.1: Sociodemographic characteristics of the respondents (n=130)

Characteristics	Mean ± SD	n (%)
Age (years)	21.98 ± 1.16	
18-21		43(33.1)
22-25		87(66.9)
Gender		
Male		31 (23.8)
Female		99 (76.2)
Ethnicity		
Malay		102 (78.5)
Chinese		18(13.8)
Indian		8(6.2)
Others		2 (1.5)
Marital Status		
Single		130(100)
Year of Study		
First year		34(26.2)
Second year		37(28.5)
Third year		35(26.9)
Fourth year		24(18.5)
Programme of Study		
B. Sc. (Human Development and Management)		48(36.9)
B. Sc. (Molecular Biology)		47 (36.2)
Bachelor of Design (Industrial Design)		35 (26.9)
Faculty		
Human Ecology		48(36.9)
Biotechnology and Molecular Science		47 (36.2)
Design and Architecture		35 (26.9)
Family Monthly Income (RM)	5274.98 ± 4484.37	
Low (≤ RM4,849.99)		77(59.2)
Middle (RM4,850 – RM10,959.99)		40(30.8)
High ≥ RM10,960		13(10.0)
Location of Stay during COVID-19 Pandemic		
Family household (with parents)		75(57.7)
Rental house (without parents)		11(8.5)
Residential college		44(33.8)

4.2 Body Mass Index (BMI)

Table 4.2 showed the descriptive statistics for body weight status of the respondents. The mean weight was 57.12 ± 14.13 kg and the mean height was 160.18 ± 7.95 cm. Meanwhile the mean BMI for the respondents was 22.23 ± 5.23 kg/m^2 indicated the normal body weight. According to the BMI classification, more than half (55.4%) of the respondents had normal body weight followed by underweight (23.1%) and overweight (13.8%). Obese respondents recorded the least percentage (7.7%) with total number of 10 respondents.

The mean BMI for this study was consistent with previous studies among university students in Malaysia where the mean BMI was in the category of normal weight with percentage distribution for normal body weight was more than half of the respondents (Chin et al., 2020; Mokhtari et al., 2015). Similarly in Iran and Kuwait, majority of the respondents had normal body weight with small distribution of underweight, overweight and obese (Alkazemi, 2019; Fatemeh & Esra, 2021). The results from previous studies were collected before the outbreak of COVID-19 pandemic. The consistent findings from the current and previous studies showed most of the respondents were had normal weight. This assumed that majority of the undergraduate students were aware and had least problem with body weight status problem despite of having outbreak of pandemic or not.

Table 4.2: Body weight status of the respondents (n=130)

Body weight status	Mean ± SD	n (%)
Weight (kg)	57.12 ± 14.13	
Height (cm)	160.18 ± 7.95	
BMI (kg/m^2)	22.23 ± 5.23	
Underweight (<18.5)		30(23.1)
Normal weight (18.5-24.9)		72(55.4)
Overweight (25.0-29.9)		18(13.8)
Obese (≥30.0)		10(7.7)

4.3 Body Image Perception

Table 4.3 showed the descriptive statistics for category for body image perception of the respondents. 46.9% (n=61) of the respondents had no concern of their body image. Meanwhile, there were 53.1% in total who had mild to marked concern of their body image which 13.1% were mild, 17.7% were moderate and 22.3% were marked concern of their body image. The mean score for body image perception was 23.5 ± 12.58.

Previous local study found that more than half of Malaysian university students had mild to marked concern of their body shape (Latiff et al., 2014). Similarly in Brazil, Duarte et al. (2021) found majority of nursing students had mild to marked concern of their body shape. Contrarily, Radwan et al. (2018) found most of university students in United Arab Emirates (UAE) were had no concern with their body shape. The finding for body image perception for this study was consistent with previous local study and Brazil but inconsistent with study from United Arab Emirates (UAE). The data from previous studies were collected before the COVID-19 pandemic and there no current study was found that assessed the body image perception of university students during this pandemic. The high percentage on the respondents who had concern with their body image showed that undergraduate students were aware with their body shape as at this stage of ages, having good body image was important which it could boost someone's confidence.

Table 4.3: Category for body image perception of the respondents (n=130)

Category of Body Image Perception	Mean ± SD	n (%)
Body Image Perception	23.5 ± 12.58	
No concern (8-18 scores)		61(46.9)
Mild concern (19-25 scores)		17(13.1)
Moderate concern (26-33 scores)		23(17.7)
Marked concern (34-48 scores)		29(22.3)

4.4 Physical Activity

Table 4.4 showed the descriptive statistics for physical activity level of the respondents. The mean for the total days spent to do physical activity was 6.48 ± 5.38. The median for total of durations spent was 200 (438) minutes. Meanwhile, the median for the total physical activity was 1080 (2390) METs. Based on the physical activity level category, almost half (48.4%) of the respondents had low physical activity level, followed by moderate physical activity level (28.5%) and high physical activity level (23.1%).

This study finding on physical activity was slightly different from previous study where the percentage of respondents who had low, moderate and high physical activity were less than 40% (Mokhtari et al., 2015). Besides, Al-hassany et al. (2020) found more than half of university students in Malaysia had moderate physical activity level. On the other hand, De-Mateo-Silleras et al. (2019) reported that almost 80% of the respondents were had low physical activity, and few had moderate and high physical activity level. Difference in the number of percentage of the physical activity level from previous study might be due to different situation of the data collection. During COVID-19 pandemic, people were restricted from doing outdoor physical activity due to the movement control order period in order to curb the spread of virus. This restriction order caused the physical activity became limited. Hence, the restriction resulted in a low physical activity level among university students.

Table 4.4: Physical activity level of the respondents (n=130)

Physical Activity Level	Mean ± SD/ Median (IQR)	n (%)
Total of days spent	6.48 ± 5.38	
Total of durations spent (minutes)	200 (438)	
Total physical activity (METs value)	1080 (2390)	
Physical Activity Levels		
Low (<600 METs)		63(48.4)
Moderate (≥600-2999 METs)		37(28.5)
High (≥3000 METs)		30(23.1)

4.5 Sleep Quality

Table 4.5 showed the descriptive statistics for category for sleep quality of the respondents. There were 55.4% (n=72) of the respondents had poor sleep quality and 44.6% (n=58) had good sleep quality. The mean global sleep quality score was 6.44 ± 3.194.

The mean score for this study was consistent with previous local study which the mean score for sleep quality was in the poor sleeper category with proportion more than half of the respondents had poor sleep quality (Gan et al., 2019). Similarly, college nursing students in Northeast United State were recorded to had poor sleep quality (Zhang et al., 2018). Inversely in Thailand and China, the mean score for sleep quality was in good sleeper category with proportion less than half of the respondents had poor sleep quality (Pensuksan et al., 2016; Wang et al., 2019). The inconsistent findings with previous studies might be due to the difference timeframe and situation of the data was collected. As this study was conducted during the pandemic, most of the respondents who had poor sleep quality might have the problem with the worriedness of the current cases of pandemic and the burden of changes in online academic (Chen et al., 2020).

Table 4.5: Category for sleep quality of the respondents (n=130)

Category of Sleep Quality	Mean ± SD	n (%)
Sleep Quality	6.44 ± 3.19	
Good sleeper (≤5 scores)		58(44.6)
Poor sleeper (>5scores)		72(55.4)

4.6 Mental Health Status

The descriptive statistics for mental health status and its subscale were described in Table 4.6. Overall, 85.4% of respondents had less severe mental health status and only 14.5% had severe mental health status with less severe mean score 31.18 ± 24.24. According to the severity distribution of each subscale, 55.4% had normal score and 44.6% had depression symptoms with proportion 13.8% were mild, 17.7% were moderate, 6.9% severe and 6.2% extremely severe depression symptoms. Meanwhile, 6.9% were having mild, 25.4% were moderate, 11.5% severe and 13.1% extremely severe anxiety symptoms. For stress subscale, about 11.5% had mild and moderate, 4.6% severe and 1.5% extremely severe stress symptoms. Based on the DASS-21 score, the mean scores of depression subscale were at mild level (9.86 ± 8.96), mean anxiety scores at moderate level (10.23 ± 8.59), and mean stress scores were at normal level (11.09 ± 8.80).

Previous studies recorded lower percentages on depression, anxiety and stress symptoms compared to this study (Ma et al., 2020; Sundarasen et al., 2020; Wang et al., 2020; Wang et al., 2020; Wathelet et al., 2020). Previous study in Malaysia found 8% of university students were detected to have anxiety symptoms during the COVID-19 pandemic (Sundarasen et al., 2020). Meanwhile, a large scale study from China found a small percentage of the respondents who had depression and anxiety symptoms during the early phase of COVID-19 pandemic (Wang et al., 2020). Similarly, studies from China and France found not more than 50% of the

respondents had depression, anxiety and stress symptoms during the pandemic (Ma et al., 2020; Wang et al., 2020; Wathelet et al., 2020). Although there were differences in the percentage, the depression, anxiety and stress were prevalent among university students during the COVID-19 pandemic. The difference in the percentage might be due to the different number of sample and different instruments used to assess the mental health problems. Instruments used affecting the data because different instrument had different cut-off point in assessing the problems.

Table 4.6: Descriptive table for mental health status and its subscales (n=130)

Variables	Mean ± SD	n (%)
Mental Health Status	31.18 ± 24.24	
Less Severe (<60 scores)		111(85.4)
Severe (≥60 scores)		19(14.6)
Depression subscale	9.86 ± 8.96	
Normal (≤9 scores)		72(55.4)
Mild (10-13scores)		18(13.8)
Moderate (14-20 scores)		23(17.7)
Severe (21-27 scores)		9(6.9)
Extremely severe (≥28 scores)		8(6.2)
Anxiety subscale	10.23 ± 8.59	
Normal (≤7 scores)		56(43.1)
Mild (8-9 scores)		9(6.9)
Moderate (10-14 scores)		33(25.4)
Severe (15-19 scores)		15(11.5)
Extremely severe (≥20 scores)		17(13.1)
Stress subscale	11.09 ± 8.80	
Normal (≤14 scores)		92(70.8)
Mild (15-18 scores)		15(11.5)
Moderate (19-25 scores)		15(11.5)
Severe (26-33 scores)		6(4.6)
Extremely severe (≥34 scores)		2(1.5)

4.7 Associations between Sociodemographic with Mental Health Status

With regards to fulfil the assumptions of chi square test, ethnicity, year of study, family monthly income and location of stay during COVID-19 were regrouped into two groups. Ethnicity was regrouped into Bumiputera and Non-Bumiputera where Bumiputera included Malay, Sabahan and Sarawakian, while non-Bumiputera included Chinese and Indian. For year of study, year one and year two were regrouped in one group while year three and year four were regrouped in another group. Family monthly income was regrouped into no more than RM4,849.99 and no less than RM4,850. Meanwhile, location of stay during COVID-19 pandemic was regrouped into stay with parent or without parent. Regrouped of without parent was the combination of respondents who stayed in residential college and rental house. For depression, anxiety and stress subscales, each subscale was regrouped into two groups which were no symptoms and had symptoms. The group that had symptoms was the combination of mild, moderate, severe and extremely severe level. Each factors was tested its association with each subscales of mental health. The significant value was measured at $p<0.05$.

Chi square test and Pearson correlation test showed that age was not associated with mental health age, where x^2(df= 1,130)=0.171, p=0.679 and age [r(130)=0.033, p=0.713]. 73.7% (n=14) of older age group (22-25 years old) had severe mental health with score more than 60. Comparing with each subscale, chi square test showed no association was found between age with depression [x^2(df=1,130) = 0.399, p=0.529], anxiety [x^2(df=1,130)=0.000, p=1.000], and stress [x^2(df=1,130)=0.001, p=0.977]. There were no associations, but result showed older age group (22-25 years old) reported the highest percentage that showed depression symptoms (70.7%), anxiety symptoms (67.6%) and stress symptoms (68.4%).

Similarly, Pearson correlation also showed no correlation between age with depression [$r(130)=0.528$, $p=0.603$], anxiety [$r(130)=0.044$, $p=0.620$], and stress [$r(130)=0.000$, $p=0.999$]. Symptoms of depression, anxiety and stress were not found among undergraduate students. This study findings were consistent with previous study which age was found had no associations with depression, anxiety and stress subscales (Jia & Loo, 2018; Latiff et al., 2014). Similarly, a study in China reported that age was not associated with depression, anxiety and stress subscales during the initial outbreak of COVID-19 (Wang et al., 2020). Constantly used of social media among the youngster to access the information on COVID-19 pandemic could be exhausted and could affected students' mental health which triggered the feeling of anxious (Sundarasen et al., 2020). Therefore, age was found been associated with anxiety (Sundarasen et al., 2020). However, this study finding was inconsistent with current study.

Gender showed no significant association with mental health ($p=0.561$). Focusing down to the subscales, results showed depression [$x^2(df=1,130)=1.221$, $p=0.269$], anxiety [$x^2(df=1,130)=0.000$, $p=1.000$], and stress [$x^2(df=1,130)=1.344$, $p=0.246$] subscales had no association with gender. Female respondents showed the highest percentage who reported had depressive symptoms (70.7%), anxiety symptoms (75.7%), and stress symptoms (84.2%). Previous studies showed anxiety and stress was not associated with gender (Jia & Loo, 2018; Latiff et al., 2014; C. Wang et al., 2020). Contradict, previous study found that gender was associated with depression and anxiety symptoms (Latiff et al., 2014; Liu et al., 2020; Sundarasen et al., 2020a; Wang et al., 2020). Different encounter in social factors caused male and female were susceptible to experience depression (Latiff et al., 2014). During current

pandemic, greater emotion expression exerted by female with a low coping strategy could trigger unexpected anxiety (Sundarasen et al., 2020).

Fischer exact test showed there was an association between ethnicity with mental health (p=0.013). According to the subscales, no significant associations were found between ethnicity with depression [x^2(df=1,130)=0.858, p=0.354], anxiety [x^2(df=1,130)=0.331, p=0.565], and stress [x^2(df=1,130)=2.233, p=0.135]. Majority of the respondents who reported depressive symptoms (84.5%), anxiety symptoms (82.4%) and stress symptoms (89.5%) were bumiputera. This findings were consistent with previous study which ethnicity was found had no associations with depression and anxiety (Latiff et al., 2014; Sundarasen et al., 2020). Inconsistently, few studies found ethnicity and stress were significantly associated with each other (Latiff et al., 2014; Shamsuddin et al., 2013). Cultural differences had affected one's mental health. For instance, each ethnicity has its own perspective on the alternative ways in combating COVID-19 pandemic. Some old folks in some ethnicity believe that braised clove can be used to avoid from being infected with the COVID-19 and forced the younger generation to practice it. They also refused to be treated by the professional healthcare. This belief somehow affected those younger fellow with more advanced knowledge became stressed as they being forced to practice the belief and stressed to think ways to spread the better knowledge to the old folks. However, this study finding showed that the cultural differences during this pandemic had no effect on students' mental health which showed that every ethnic were facing the same struggle and difficulties in combating the pandemic.

No association was found between year of study with mental health year of study [x^2(df=1,130)=0.876, p=0.349]. Depression [x^2(df=1,130)=0.876, p 0.349], anxiety year of study [x^2(df=1,130)=0.105, p=0.745], and stress [x^2(df=1,130)=0.010,

p=0.922] subscales also found no significant associations with year of study. Among those reported depressive symptoms, 57.9% were from later year of study (third and fourth year). Meanwhile 52.7% who reported anxiety symptoms and 52.6% reported stress symptoms were from early year of study (first and second year). Consistently, previous study showed that year of study had no associations with depression and anxiety (Latiff et al., 2014; Shamsuddin et al., 2013). Inconsistently, students in Jordan reported a significant association between year of study and stress during COVID-19 pandemic (Seetan et al., 2021). Jia and Loo (2018) also found year of study was significantly associated with stress with first year students perceived more stress compared to other year. In this study, the sudden changes in the mode of classes from physical to online classes due to pandemic had no effect on the students' mental health. The small sample sizes with few selected programmes of study were not strong to find the association between year of study and mental health.

Both programme of study and faculty were found not associated with mental health [x^2(df=2,130)=0.1455, *p*=0.482]. According to each subscale, no associations were found between programme of study and faculty with depression [x^2(df=2,130)=3.867, *p*=0.145], anxiety [x^2(df=2,130)=1.511, *p*=0.470], and stress[x^2(df=2,130)=1.533, *p*=0.465]. Respondents reported depressive symptoms (36.2%), anxiety symptoms (39.2%) and stress symptoms (42.1%) were majoring in Bachelor Science (Molecular Biology) from Faculty of Biotechnology and Molecular Science. The programmes selected in this study were from field of art and social science, sciences, and technical. These three selected field of study had no associations with depression, anxiety and stress. This finding was consistent with previous study which programme of study was not associated with depression and

stress (Latiff et al., 2014). However, the same study found anxiety and programme of study were significantly associated (Latiff et al., 2014). Heavy course workload, limited leisure time, lack of access to learning materials and regular assessments can be added as the factor point on students' anxiety. The students from selected programmes in this study expected to have a good management on the psychological health during this pandemic. Thus, no associations were found.

Chi square and Pearson correlation test showed that family monthly income had no association with mental health, where x^2(df=2,130)=0.1936, p=0.164 and [r (130)=0.103, p=0.245] respectively. Referred to each subscale, income was not associated with depression [x^2(df=1,130)=0.443, p=0.506], anxiety [x^2(df=1,130)=0.014, p=0.905], and stress [x^2(df=1,130)=0.621, p=0.431] subscales. Over half of the respondents who reported depressive symptoms (55.2%), anxiety symptoms (53.1%) and stress symptoms (52.6%) were from low income family (<RM5000). Pearson correlation test also showed no association was found between family monthly income with depression [r(130)=0.037, p=0.675], anxiety [r(130)=0.143, p=0.104], and stress [r(130)=0.105, p=0.235] subscales. There were no associations were found between family monthly income with depression and anxiety. This finding was consistent with previous study that was conducted before the COVID-19 pandemic (Latiff et al., 2014; Shamsuddin et al., 2013). Inconsistently, a study conducted during COVDI-19 pandemic found that those from lowest household income had significant elevated depression and anxiety symptoms (Rudenstine et al., 2021). For stress, previous study showed students with lower income were more likely to have stress symptoms (Shamsuddin et al., 2013). Financial difficulties were usually faced by students who came from poor families. Difficulty to smooth their expenses caused them to find other sources of income that

resulted to perceive stress (Kandasamy et al., 2020). With the current pandemic, unemployment among parents gave adding point for the students to acquire either depression, anxiety or stress symptoms. With the initiative from government to provide financial aids for the low income family during this pandemic helped lessen the financial worriedness among students. Thus, income was found not associated with any of the subscales.

Location of stay during COVID-19 pandemic was found not associated with mental health [x^2(df=2,130)=3.026, p=0.082]. Based on each subscale, no associations were found between location of stay during COVID-19 pandemic with depression [x^2(df=1,130)=3.140, p=0.076], anxiety [x^2(df=1,130)=1.310, p=0.252], and stress [x^2(df=1,130)=0.309, p=0.579]. Respondents who reported depressive symptoms (51.7%) were high among those lived without parent during this pandemic. On the other hand, respondents who reported anxiety symptoms (52.7%) and stress symptoms (52.6%) were from those lived with parents during this pandemic. These study finding was contradict with previous study. Previous study showed that there not living with family was associated with symptoms of depression and stress (Wathelet et al., 2020). Current living arrangement showed an insignificant association with risk of anxiety (Sundarasen et al., 2020). During this pandemic, homesickness and feeling of fear being away from family had affected mental health of university students (Wathelet et al., 2020). However, this study result showed that neither lived with parent or without parent had no effect on students' mental health as both living arrangement had good support system. In this pandemic, a strong support system with family or friends could help people to be away from any mental health.

Table 4.7: Associations between sociodemographic characteristics and mental health (n=130)

	Mental health		x^2	p-value	*r*	p-value
	Less severe (n=111)	Severe (n=19)				
Age (years)			0.171	0.679	0.033	0.713
18-21	38(34.2)	5(26.3)				
22-25	73(65.8)	14(73.7)				
Gender[a]				0.561		
Male	28(25.2)	3(15.8)				
Female	83(74.8)	16(84.2)				
Ethnicity[a]				0.013		
Bumiputera	85(76.6)	19(100.0)				
Non-Bumiputera	26(23.5)	0				
Year of Study			0.876	0.349		
First & second year	63(56.8)	8(42.1)				
Third & fourth year	48(43.2)	11(57.9)				
Programme of Study			1.455	0.482		
B. Sc. (HDM)	43(38.7)	5(26.3)				
B. Sc. (MB)	38(34.2)	9(47.4)				
Bachelor of Design (ID)	30(27.0)	5(26.3)				
Faculty			1.455	0.482		
Human Ecology	43(38.7)	5(26.3)				
Biotechnology and Molecular Science	38(34.2)	9(47.4)				
Design and Architecture	30(27.0)	5(26.3)				
Family Monthly Income (RM)			1.936	0.164	0.103	0.245
≤ RM4,849.99	69(62.2)	8(42.1)				
≥RM4,850	42(37.8)	11(57.9)				
Location of Stay during COVID-19 Pandemic			3.026	0.082		
With parents	68(61.3)	7(36.8)				
Without parents	43(38.7)	12(63.2)				

[a] Fischer Exact Test, HDM: Human and Development Management, MB: Molecular Biology, ID: Industrial Design

Table 4.8: Associations between sociodemographic characteristics with depression, anxiety and stress subscale (n=130)

Variables	Depressive symptoms				Anxiety symptoms				Stress symptoms			
	No (n=72)	Yes (n=58)	x^2	p-value	No (n=56)	Yes (n=74)	x^2	p-value	No (n=92)	Yes (n=38)	x^2	p-value
Age (years)			0.399	0.528			0.000	1.000			0.001	0.977
			r=0.046[a]	0.603			r=0.044	0.620			r=0.000[a]	0.999
18-21	26(36.1)	17(29.3)			19(33.9)	24(32.4)			31(33.7)	12(31.6)		
22-25	46(63.9)	41(70.7)			37(66.1)	50(67.6)			61(66.3)	26(68.4)		
Gender			1.221	0.269			0.000	1.000			1.344	0.246
Male	14(19.4)	17(29.3)			13(23.2)	18(24.3)			25(27.2)	6(15.8)		
Female	58(80.6)	41(70.7)			43(76.8)	56(75.7)			67(72.8)	32(84.2)		
Ethnicity			0.858	0.354			0.331	0.565			2.233	0.135
Bumiputera	55(76.4)	49(84.5)			43(76.8)	61(82.4)			70(76.1)	34(89.5)		
Non-Bumiputera	17(23.6)	9(15.5)			13(23.2)	13(17.6)			22(23.9)	4(10.5)		
Year of Study			0.876	0.349			0.106	0.745			0.010	0.922
First & second year	63(56.8)	8(42.1)			32(57.1)	39(52.7)			51(55.4)	20(52.6)		
Third & fourth year	48(43.2)	11(57.9)			24(42.9)	35(47.3)			41(44.6)	18(47.4)		
Programme of Study			3.867	0.145			1.511	0.470			1.533	0.465
B. Sc. (HDM)	31(43.1)	17(29.3)			24(42.9)	24(32.4)			37(40.2)	11(28.9)		
B. Sc. (MB)	26(36.1)	21(36.2)			18(32.1)	29(39.2)			31(26.1)	16(42.1)		
Bachelor of Design (ID)	15(20.8)	20(34.5)			14(25.0)	21(28.4)			24(26.1)	11(28.9)		
Faculty			3.867	0.145			1.511	0.470			1.533	0.465
Human Ecology	31(43.1)	17(29.3)			24(42.9)	24(32.4)			37(40.2)	11(28.9)		
Biotechnology and Molecular Science	26(36.1)	21(36.2)			18(32.1)	29(39.2)			31(26.1)	16(42.1)		
Design and Architecture	15(20.8)	20(34.5)			14(25.0)	21(28.4)			24(26.1)	11(28.9)		
Family Monthly			0.443	0.506			0.014	0.905			0.621	0.431
Income (RM)			r=0.037[a]	0.675			r=0.143	0.104			r=0.105[a]	0.235
≤ RM4,849.99	45(62.5)	32(55.2)			34(60.7)	43(53.1)			57(62.0)	20(52.6)		
≥RM4,850	27(37.5)	26(44.8)			22(39.3)	31(41.9)			35(38.0)	18(47.4)		

Table 4.8 continued

Variables	Depressive symptoms				Anxiety symptoms				Stress symptoms			
	No (n=72)	Yes (n=58)	x^2	p-value	No (n=56)	Yes (n=74)	x^2	p-value	No (n=92)	Yes (n=38)	x^2	p-value
Location of Stay during COVID-19 Pandemic			3.140	0.076			1.310	0.252			0.309	0.579
With parents	47(65.3)	28(48.3)			36(64.3)	39(52.7)			55(59.8)	20(52.6)		
Without parents	25(34.7)	30(51.7)			20935.7)	35(47.3)			37(40.2)	18(47.4)		

[a] Pearson Correlation test, HDM: Human and Development Management, MB: Molecular Biology, ID: Industrial Design

4.8 Associations between BMI with Mental Health Status

A Pearson correlation and chi square test were used to analyse the data for the associations between BMI with mental health status (shown in Table 4.9) and its subscales (shown in Table 4.10). The significant value was set at $p<0.05$.

Pearson correlation test showed body weight status was found associated with mental health [$r(130)=0.182$, $p=0.038$] but vice versa with chi square test [$x^2(df=3,130)=5.868$, $p=0.096$]. Comparing with subscale, Pearson correlation test showed body weight status was found significantly and positively associated with depression subscale [$r(130)=0.205$, $p=0.019$] indicated a significant linear relationship between these two variables but the strength of this relationship was weak. According to chi square test, there was no association between body weight status with depression subscale [$x^2(df=3,130)=3.376$, $p=0.337$]. The proportions showed that respondents with depressive symptoms were had normal body weight (55.2%). For anxiety subscale, both statistical test showed no correlation between body weight status with anxiety [$r(130)=0.129$, $p=0.144$; $x^2(df=3,130)=2.398$, $p=0.494$]. Pearson correlation and chi square test showed no associations between body weight status with stress subscale where $r(130)=0.167$, $p=0.058$ and $x^2(df=3,130)=7.550$, $p=0.056$ respectively.

Current pandemic gave impact on the body weight status of the respondents that lead to acquired depressive symptoms. Body mass index (BMI) was found positive significantly correlated with depression but in a weak relationship. It showed that individuals who had high BMI were tend to had depressive symptoms. Similarly, previous study found BMI was correlated with depression which respondents who obese tend to had depression (Tashakori et al., 2016; Weinberger et al., 2018). A study suggested that obesity could lead depression and weight management can

improve one's mood, but this improvement may not be the result for the actual weight. Thus, it leads to perceived depression (Tashakori et al., 2016). Conversely, studies among Malaysian university students showed that there was no association between BMI and depression (Amir Hamzah et al., 2019; Latiff et al., 2014; Mokhtari et al., 2015). No associations were found between BMI with anxiety and supported by Amir Hamzah et al. (2019) and Latiff et al. (2014) but in contrast with (Mohamad et al., 2021; Mokhtari et al., 2015). No associations were found between BMI and stress which supported by Amir Hamzah et al. (2019) and Latiff et al. (2014). These contradict finding might be due to the self-reported data on BMI which the respondents be biased with the data given and data were collected in different life event.

4.9 Associations between Body Image Perception with Mental Health Status

A Pearson correlation and chi square test were used to analyse the data for the associations between body image perception with mental health status (shown in Table 4.9) and its subscales (shown in Table 4.10). The significant value was set at $p<0.05$.

From the table, it showed that both statistical test showed that body image perception was significantly associated with mental health [$r(130)=0.530$, $p<0.0005$; $x^2(df=1,130)=10.186$, $p=0.001$]. Correspondingly, body image perception was significantly and positively associated with depression subscale at a strong strength of relationship [$r(130)=0.538$, $p<0.0005$]. Similarly, chi square test showed there was associations between body image perception with depression [$x^2(df=1,130)=14.352$, $p<0.0005$]. Respondents who concerned with their body image acquired depressive symptoms were 72.4%. A medium significant correlation was found between body image perception with anxiety subscale [$r(130)=0.449$, $p<0.0005$]. Chi square test

also showed body image perception was associated with anxiety subscale [x^2(df=1,130)=10.715, p= 0.001] with respondents who had concern with their body shape were prevalent in those who had anxiety symptoms (66.2%). Similarly, both statistical test showed body image perception was correlated with stress subscale [r(130)=0.473, p<0.0005; x^2(df=1,130)=12.999, p<0.0005]. 78.95% of the concerned respondents with their body shape had shown stress symptoms.

A positive significantly correlation between body image perception and depression found in this study was supported by previous study conducted by Barnes et al. (2020), Edman et al. (2014), Latiff et al. (2014), and Scheffers et al. (2019). In other words, respondents who had more concern with their body shape then to become depressed. Besides, there was a positive significant correlation between body image perception with anxiety. The more concern of body shape significantly increased with the higher anxiety score. This finding was supported by Barnes et al. (2020) and Latiff et al. (2014). The result from this study revealed that body image perception was associated with stress which was supported by Latiff et al. (2014). Body image perception showed a medium strength of relationship between the two variables, indicating the higher score of body shape significantly increased with the higher score of stress. However, Fatemeh & Esra, (2021) reported that body image perception was no associated with stress. Study revealed that exposure to social media and networks, and low self-esteem was associated with body image dissatisfaction (Fatemeh & Esra, 2021). Over concern on the body image create the stressor situation that lead to the outbreak of depressive symptoms (Fatemeh & Esra, 2021). In relation to current situation, the increasing rate of screen time (Giuntella et al., 2021) on social media created a feeling of insecurity with body shape when comparing with those in the social media. The feeling of insecurity leads to the

dissatisfaction on body image and affect the students emotion. Therefore, during this pandemic the body image perception was found associated with depression, anxiety and stress symptoms.

4.10 Associations between Physical Activity with Mental Health Status

A spearman correlation and chi square test were used to analyse the data for the associations between physical activity with mental health status (shown in Table 4.9) and its subscales (shown in Table 4.10). The significant value was set at $p<0.05$.

Physical activity was not significantly associated with mental health [$r(130)=0.139$, $p=0.116$; $x^2(df=2,130)=5.148$, $p= 0.076$]. Both statistical tests showed that there were no significant correlations between physical activity with depression subscale [$r(130)=0.168$, $p=0.058$; $x^2(df=2,130)=1.236$, $p=0.539$]. There was 44.8% of students with low physical activity level reported had depressive symptoms. Similarly, anxiety subscale showed no statistical significant correlations with physical activity level with both test [$r(130)=0.120$, $p=0.174$; $x^2(df=2,130)=1.334$, $p=0.513$]. 45.9% of students with low level of physical activity reported anxiety symptoms. Spearman correlation and chi square test showed no associations were found between physical activity with stress subscale where $r(130)=0.093$, $p=0.292$ and $x^2(df=2,130)=1.868$, $p=0.393$ respectively. There were 42.1% of students with low physical activity level reported stress symptoms.

No association was found between physical activity with depression which supported with previous study conducted by Edman et al. (2014). Conversely, few studies found significant association between physical activity and depression subscale (Islam et al., 2020; Deepthi et al., 2015; Pilipović-Spasojević et al., 2020). A cohort study conducted in United State during pandemic showed that the physical activity

among respondents declined from the 2019 to 2020 spring cohort and significantly associated with depression (Giuntella et al., 2021). An intervention was conducted and the result suggested that maintaining healthy physical habits was strongly associated with well-being during pandemic (Giuntella et al., 2021). Physical activity was found had no association with anxiety subscale. It showed that neither physically active nor physically inactive was associated with anxiety. This finding was supported by Akhtarul Islam et al. (2020) where anxiety was found prevalent among those who had no physical exercise. Furthermore, physical activity also found had no association with stress subscale. It showed that none of the physical activity level was associated with stress. This finding was supported by Pilipović-Spasojević et al. (2020). Vizbaraitė and Morkūnaitė (2017) found that there were no difference between physical activity and perceived stress among male and female students. The used of different instruments and self-reported data that required the respondents to recall their previous one week activity could contributed to the difference in the findings with pervious study.

4.11 Associations between Sleep Quality with Mental Health Status

A Pearson correlation and chi square test were used to analyse the data for the associations between sleep quality with mental health status (shown in Table 4.9) and its subscales (shown in Table 4.10). The significant value was set at $p<0.05$.

Result showed that sleep quality was significantly associated with mental health [$r(130)=0.508$, $p<0.0005$; $x^2(df=1,130)=8.911$, $p=0.003$]. There was a significant correlation between sleep quality with depression subscale with a medium strength of relationship [$r(130)=0.460$, $p<0.0005$]. Chi square test on sleep quality also showed a significant association between sleep quality and depression subscales [$x^2(df=1,130)=13.566$, $p<0.0005$]. 74.1% of poor sleeper respondents showed

depressive symptoms. Correspondingly, both Pearson correlation and chi square test showed there were significant correlation between sleep quality with anxiety subscale, where $r(130)=0.450$, $p<0.0005$ and $x^2(df=1,130)=7.170$, $p<0.0005$ respectively. There were 66.2% of poor sleeper who showed anxiety symptoms. Next, a significant correlation also found in sleep quality and stress subscale. Pearson correlation showed a medium strength of relationship between sleep quality and stress subscale [$r(130)=0.492$, $p<0.0005$]. Likewise, chi square test showed significant association between sleep quality and stress subscale [$x^2(df=1,130)=16.446$, $p<0.0005$] with 84.2% of poor sleeper had stress symptoms.

Sleep quality was found had medium positive correlation with depression. This association indicated that people with poor sleep quality tend to had depression. This finding was supported by previous studies conducted by Ashraful et al. (2018), Pensuksan et al. (2016), Rosso et al. (2020), and Zhang et al. (2018). Chen et al. (2020) also found significant association between sleep quality with depression among China population during the COVID-19 pandemic. It is predicted that later sleep timing during pandemic lead to rising of mood disorder and increased depressive symptoms (Giuntella et al., 2021). A significant correlation also found in sleep quality with anxiety which supported by (Pensuksan et al., 2016). It showed that the higher the sleep quality score, the higher the anxiety score. In line with stress subscale, the higher the sleep quality score, the higher the stress score. The higher sleep quality score indicated the poor sleep quality. This was supported with previous study conducted by Pensuksan et al. (2016). Short sleep duration was found associated with mental health and became the mediator for mental health (Tang et al., 2020).

Table 4.9: Associations between BMI, body image perception, physical activity and sleep quality with mental health status (n=130)

Variables	Mental health		x^2	p-value	*r*	p-value
	Less severe (n=111)	Severe (n=19)				
BMI (kg/m^2)			5.868	0.096	0.182	0.038*
Underweight	28(25.2)	2(10.5)				
Normal	61(55.0)	11(57.9)				
Overweight	16(14.4)	2(10.5)				
Obese	6(5.4)	4(21.1)				
Body image perception			10.186	0.001**	0.530	0.000**
No concern	59(53.2)	2(10.5)				
Have concern	52(46.8)	17(89.5)				
Physical activity level[a]			5.148	0.076	0.139	0.116
Low	58(52.3)	5(26.3)				
Moderate	28(25.2)	9(47.4)				
High	25(22.5)	5(26.3)				
Sleep quality			8.911	0.003**	0.508	0.000**
Good sleeper	56(50.5)	2(10.5)				
Poor sleeper	55(49.5)	17(89.5)				

[a]Spearman test, *p<0.05, **p<0.01

Table 4.10: Associations between BMI, body image perception, physical activity and sleep quality with depression, anxiety and stress (n=130)

Variables	Depressive symptoms				Anxiety symptoms				Stress symptoms			
	No (n=72)	Yes (n=58)	*r*	p-value	No (n=56)	Yes (n=74)	*r*	p-value	No (n=92)	Yes (n=38)	*r*	p-value
BMI (kg/m^2)			0.205	0.019*			0.129	0.144			0.167	0.058
			x^2=3.376[a]	0.337			x^2=2.398[a]	0.494			x^2=7.550[a]	0.056
Underweight	19(26.4)	11(19.0)			14(25.0)	16(21.6)			25(27.2)	5(13.2)		
Normal	40(55.6)	32(55.2)			32(57.1)	40(54.1)			49(53.3)	23(60.5)		
Overweight	10(13.9)	8(13.8)			8(14.3)	10(13.5)			14(15.2)	4(10.5)		
Obese	3(4.2)	7(12.1)			2(3.6)	8(10.8)			4(4.3)	6(15.8)		
Body image perception			0.538	0.000**			0.449	0.000**			0.473	0.000**
			x^2=14.352[a]	0.000**			x^2=10.715[a]	0.001**			x^2=12.999[a]	0.000**
No concern	45(62.5)	16(27.6)			36(64.3)	25(33.8)			53(57.6)	8(21.1)		
Have concern	27(37.5)	42(72.4)			20(35.7)	49(66.2)			39(42.4)	30(78.9)		
Physical activity level			0.168[b]	0.058			0.120[b]	0.174			0.093[b]	0.292
			x^2=1.236[a]	0.539			x^2=1.334[a]	0.513			x^2=1.868[a]	0.393
Low	37(51.4)	26(44.8)			29(51.8)	34(45.9)			47(51.1)	16(42.1)		
Moderate	21(29.2)	16(27.6)			13(23.2)	24(32.4)			23(25.0)	14(36.8)		
High	14(19.4)	16(27.6)			14(25.0)	16(21.6)			22(23.9)	8(21.1)		
Sleep quality			0.460	0.000**			0.450	0.000**			0.492	0.000**
			x^2=13.566[a]	0.000**			x^2=7.171[a]	0.007**			x^2=16.446[a]	0.000**
Good sleeper	43(59.7)	15(25.9)			33(58.9)	25(33.8)			52(56.5)	6(15.8)		
Poor sleeper	29(40.3)	43(74.1)			23(41.1)	49(66.2)			40(43.5)	32(84.2)		

[a]Chi square test, [b]Spearman test * p-value<0.05, **p-value<0.01

CHAPTER 5

CONCLUSION, LIMITATIONS, RECOMMENDATION

5.1 Conclusion

Overall, 14.6% of the respondents were having severe mental health with 44.6% having depression symptoms, 56.9% having anxiety symptoms and 29.2% having stress symptoms with severity mild to extremely severe. Sociodemographic characteristics found majority of the respondents were females, Malay, in second year of study, from low income family and stayed with family during COVID-19 pandemic. More than half of the respondents had normal body weight status, had concern with their body image, moderate to high physical activity and categorise in poor sleeper. These study findings showed that body weight status was associated with depression subscale. Body image perception and sleep quality were associated with depression, anxiety and stress subscales. No associations were found between sociodemographic characteristics and physical activity with mental health, depression, anxiety and stress. The results from this study indicated that anxiety was prevalent among university students compared to depression and stress during this pandemic. Students who had concerned with their body image perception and had poor sleep quality were susceptible to showed depression, anxiety and stress symptoms. It showed that perception on the body image and sleep quality is important in determining one's mental health especially during this pandemic. Practicing a proper sleep duration is important in order to maintain a good mental

health. Affected students should be helped and referred to healthcare practitioner to ensure they able to overcome with these problems and remains healthy during this pandemic.

5.2 Limitations

Since the data collection was done during the movement control order of COVID-19, there are a few limitations that might affect the result such as the online survey method. Online survey method can be resulted in unfavourable result because the data collected were solely depending on the self-reported data from the respondents. Besides, online survey method also had limited the process of collecting data due to outreach of the respondents. Respondents tend to neglect the survey link that been distributed.

Next, the self-reported data from respondents can cause biased in the result. For example the weight and height measurement, the respondents might misreport the data because not all of the respondents had weighing scale at their place. If they happen to had weighing scale, they might not follow the correct procedure in weighing weight. These circumstances can affect the result. This limitation also applied to the use of DASS-21. The result from DASS-21 was not showing the diagnostic result of the respondents. Besides, this study was a cross-sectional study which this study design could not be able to identify which variables are the cause and which is the consequence.

Finally, the homogenous of the characteristics of the respondents can affect the result. This study was only focusing on the undergraduate students from UPM

with only three selected faculties. The result from this study did not be representative to all undergraduate students in UPM.

5.3 Recommendation

Based on the finding, the percentage of moderate to extremely severe depression, anxiety and stress were high. The university counsellors should use this data to help students who having this mental health problem especially during this COVID-19 pandemic. University counsellors should that a proactive action in reaching the students who had the mental health problem not only from these three courses but also from the other courses.

It is recommended for future study to include social media usage to browse COVID-19 information, academic performance and social support as the expected factors to be associated with mental health. Next, a longitudinal study is recommended in the future to determine the predictors of this mental health. Future study should focus on the wide range characteristics of respondents with large scale number of respondents. The higher the sample number, the result would be representative and precise for the sample population.

Lastly, it is recommended for the survey to be monitored by a professional evaluator to help the respondents to answer the questionnaire. The survey that required measurement should be conducted by a professional evaluator. These precautions can reduce the individual bias on the reported data.

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Appendix A: Questionnaires

Section A: Sociodemographic Characteristics

Age (years)	
Gender	___ Male ___ Female
Ethnicity	___ Malay ___ Chinese ___ Indian ___ Bumiputera Sabah ___ Bumiputera Sarawak ___ Others:_____
Marital status	___ Single ___ Married ___ Widow(er)/Divorcee
Year of study	___First year ___ Second year ___ Third year ___ Fourth year
Programme of study	
Faculty	
Family monthly income	
Location of stay during COVID-19 pandemic	___ Home (with parents) ___ Rental house (without parent) ___ College

Section B: Body Mass Index

Please record your current body weight (kg) and height (m)

Current weight (kg)	
Current height (m)	

Section C: Body Image Perception

We should like to know how you have been feeling about your appearance over the **PAST FOUR WEEKS**. Please read each question and circle the appropriate number to the right. Please answer all the questions.

OVER THE PAST FOUR WEEKS:

	Never	Rarely	Sometimes	Often	Very often	Always
1. Have you been afraid that you might become fat (or fatter)?						
2. Has feeling full (e.g. after eating a large meal) made you feel fat?						
3. Has thinking about your shape interfered with your ability to concentrate (e.g. while watching television, reading, listening to conversations)?						
4. Have you imagined cutting off fleshy areas of your body?						
5. Have you felt excessively large and rounded?						
6. Have you thought that you are in the shape you are because you lack self-control?						
7. Has seeing your reflection (e.g. in a mirror or shop window) made you feel bad about your shape?						
8. Have you been particularly self-conscious about your shape when in the company of other people?						

Section D: Physical Activity Levels

Instruction: This section will ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, seeking employment.

In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and breathe much harder than normal, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing than normal.

Think about all the **vigorous and moderate activities** that you did in the **last 7 days**. Think ***only*** about those **physical activities that you did for at least 10 minutes at a time**.

Part I: Activity at work

1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously?
   ( ) Yes ( ) No ***(Skip to question 4)***

2. In a typical week, on how many days do you do vigorous-intensity activities as part of your work?
   Number of days: ____

3. How much time do you spend doing vigorous-intensity activities at work on a typical day?
   _____hours _____minutes

4. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?
   ( ) Yes ( ) No ***(Skip to question 7)***

5. In a typical week, on how many days do you do moderate-intensity activities as part of your work?
   Number of days: ____

6. How much time do you spend doing moderate-intensity activities at work on a typical day?
   _____hours _____minutes

Part II: Travel to and from places

The next questions exclude the physical activities at work that you have already mentioned. Now, I would like to ask you about the usual way you travel to and from places. For example, to work/ study, for shopping, to market, to place of worship.

7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?
   ( ) Yes ( ) No ***(Skip to question 10)***

8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?
   Number of days: ____

9. How much time do you spend walking or bicycling for travel on a typical day?
   _____hours _____minutes

Part III: Recreational activities

The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure) such as playing footballs, yoga, jumping rope etc.

10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like running, tennis, swimming laps, high intense rope jumping, football or heavy gardening work (continuous digging, hoeing) etc. for at least 10 minutes continuously?
    ( ) Yes ( ) No ***(Skip to question 13)***

11. In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?
    Number of days: ____

12. How much time do you spend doing vigorous-intensity sports, fitness, or recreational (leisure) activities?
    _____hours _____minutes

13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking, cycling, swimming, jogging etc. for at least 10 minutes continuously?
    ( ) Yes ( ) No ***(Skip to question 16)***

14. In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?
    Number of days: ____

15. How much time do you spend doing moderate-intensity sports, fitness, or recreational (leisure) activities?
    _____hours _____minutes

Part IV: Sedentary behaviour

The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping.

16. How much time do you usually spend sitting or reclining on a typical day?
    _____hours _____minutes

Section E: Sleep Quality

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions. During the past month,

1. When have you usually gone to bed? USUAL BED TIME_____

2. How long (in minutes) has it taken you to fall asleep each night? NUMBER OF MINUTES _____

3. When have you usually gotten up in the morning? USUAL GETIING UP TIME_____

4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) HOURS OF SLEEP PER NIGHT_____

5. During the past month, how often have you had trouble sleeping because you…	Not during the past month	Less than once a week	Once or twice a week	Three or more times week
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
9. During the past month, how would you rate your sleep quality overall?				

Section F: Mental Health Status

Instruction: Please read each statement and tick (/) which indicates how much the statement applied to you **over the past week**. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
Did not apply to me at all - **NEVER**
Applied to me to some degree, or some of the time - **SOMETIMES**
Applied to me to a considerable degree, or a good part of time – **OFTEN**
Applied to me very much, or most of the time - **ALMOST ALWAYS**

No.	Items	Never	Sometimes	Often	Almost always
1.	I found it hard to wind down				
2.	I was aware of dryness of my mouth				
3.	I couldn't seem to experience any positive feeling at all				
4.	I experienced breathing difficulty (eg. Excessively rapid breathing, breathlessness in the absence of physical exertion)				
5.	I found it difficult to work up the initiative to do things				
6.	I tended to over-react to situations				
7.	I experienced trembling (eg. In the hands)				
8.	I felt that I was using a lot of nervous energy				
9.	I was worried about situations in which I might panic and make a fool of myself				
10.	I felt that I had nothing to look forward to				
11.	I found myself getting agitated				
12.	I found it difficult to relax				
13.	I felt down-hearted and blue				
14.	I was intolerant of anything that kept me from getting on with what I was doing				

15.	I felt I was close to panic				
16.	I was unable to become enthusiastic about anything				
17.	I felt I wasn't worth much as a person				
18.	I felt that I was rather touchy				
19.	I was aware of the action of my heart in the absence of physical exertion (eg. Sense of the heart rate increase, heart missing a beat)				
20.	I felt scared without any good reason				
21.	I felt that life was meaningless				

Appendix B: Information sheet and consent form

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE : Associations between Sociodemographic, Body Mass Index, Body Image Perception, Physical Activity and Sleep Quality with Mental Health among University Students in Universiti Putra Malaysia during the COVID-19 Pandemic

2. INTRODUCTION: Mental health is defined as "a state of well-being where an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community". University student is one of the population groups that have the tendency to acquire mental health problem. In Malaysia, the prevalence of mental illness increased from 21.0% in 2006 to 66.8% in 2015 (National Health and Morbidity Survey, 2006, 2015). This age group recorded the highest mental illness statistics compared to the others age group. Depression, anxiety and stress are the common mental health issues that occur among youths in universities According to the World Health Organization (WHO), mental illness is the growing public health concern that contributes to 16% of the global burden of disease injury among youths. In the midst of COVID-19 pandemic, mental health problem has been estimated to increase among university students. The updated prevalence of mental health and its associated factors among university students need to be done so that an intervention program and treatment can be done to help individuals who affected. There is no published study has been conducted on the mental health status and its association factors among university students in Malaysia during the COVID-19 pandemic. Therefore, this study is aimed to determine the associations between sociodemographic characteristics, body mass index, body image perception, physical activity and sleep quality with mental health among university students in Universiti Putra Malaysia during the COVID-19 pandemic.

3. WHAT WILL YOU HAVE TO DO?
If you agree to be part of this study, respondents are required to fill in the questionnaires given. The respondents need to fill in the questionnaires that comprised of 6 sections (Section A: Sociodemographic characteristics, Section B: Body Mass Index, Section C: Body Image Perception, Section D: Physical Activity Level, Section E: Sleep Quality and Section F: Mental Health Status). The expected duration of time required to answer the questionnaires is 20-30 minutes. The completed questionnaire need to be submitted to the researcher.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?
Your participation in this study is voluntary and does not involve any refund from both parties, researcher and participant. Participant has the right to reject this offer of participation or withdraw at any time without penalty. For your information, this participation will be joined by 156 respondents and involves Malaysian undegraduate students with age range 18 to 25 years old. International students will be excluded from this study.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

The infromation given by the respondents will be a valuable data for researcher to find the prevalence and associated factors of mental health among university students. The information given can ease the university to do intervention program to help students with mental health problem.

(b) TO THE INVESTIGATOR?

The result from this study can be used as the baseline data for future intervention program for university students. The findings of this study can create awareness among population and be more understanding towards university students

6. WHAT ARE THE POSSIBLE RISKS?

Thers is only minimal risk if you participate in this study as this study is only involve questionnaires.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

Your information will be kept confidential by the researcher and will not be disclosed unless it is required by law. By agreeing the consent form, you authorize the examination of records, analysis and use of data resulting from the research.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any questions about this research or your rights, kindly to contact Farrah Haliny binti Kudin at 010-8876065 or email at farrah.haliny@gmail.com or Dr. Noraida binti Omar at 03-97692463 or email noraidaomar@upm.edu.my

Please initial here if you have read and understood the contents of this page_____

9. CONSENT

I …… Identity Card No. …… address…… ….. ……..hereby voluntarily agree to take part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature ……..…… Signature ……..…….
(Respondent) (Witness)

Date :…….….. Name :…….…..

I/C No. :…….…..

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date ……..…… Signature ……..…….
(Researcher)