Healthy Lifestyle Components and Mental Health among Undergraduate Students

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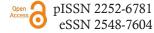
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Abstract

Background: Mental health issues among undergraduates have gained attention in recent years due to their rising incidence. Healthy lifestyle components like sleep quality, diet, physical activity, substance abuse, and social support may affect mental health. Thus, recognizing the most important components of a healthy lifestyle allows relevant parties to execute suitable treatments. **Objective**: This study aims to identify predictors of a healthy lifestyle on mental health. A cross-sectional study was carried out on a randomly selected sample of 180 undergraduate students aged 18 to 30. Significant predictors of healthy lifestyle components were identified using AHLQ and DASS 21 instruments. **Methods:** This research is quantitative research with a nested case-control study design, using electronic medical record (EMR) data from the Central Java Provincial Hospital in 2023. The variables in this study were gender, age, education level, employment status, marital status, health insurance status, BMI, DM diet, duration of DM, hypertension, other diseases, current blood glucose, and HbA1c. The analysis used was univariate, bivariate, and multivariate analysis (logistic regression). **Results:** The findings indicate a significant relationship between a healthy diet and mental health, and a healthy diet contributes 25% of variances, while 29% of mental health variance was attributed to the combination of a healthy diet and PA. Furthermore, 31% of mental health variance is attributed to sleep quality variables, and a combination of healthy diet, PA, sleep quality, and substance abuse contributes to 34% of mental health variance. **Conclusion:** This study provides insights to stakeholders in terms of incorporating healthy lifestyle components in mental health intervention strategies for undergraduate students. It was concluded that such interventions should focus on promoting a healthy diet since it is the most significant measure of good mental health.

INTRODUCTION

There has been considerable attention given to the mental health of undergraduates in recent years because of the rising incidence of mental-health-related problems within this demographic. In this regard, studies have shown that undergraduates are more likely to suffer from mental health problems than the overall population (Larson et al., 2021). Studies have reported a higher prevalence of mental health issues like

high stress, anxiety and depression among university students globally (Wong et al., 2023; Brown, 2018). Past studies like Song et al. (2008) in China and (Wong et al., 2006) reported a critical mental issue crisis among Asian university students, with 41% of Hong Kong students reporting a high level of anxiety and 9% of Chinese students exhibiting a high prevalence of depressive symptoms, respectively. In Malaysia, a similar trend was observed with studies like Khairul Azhar et al. (2023) reported that 77.9%. 80.8% and 51.9% of students at International Islamic University Malaysia students experienced moderate to extremely severe symptoms of depression and anxiety, respectively. In another study, Mohammed et al. (2016) at Universiti Putra Malaysia (UPM) reported that out of the 675 students surveyed, 32.1% experienced symptoms of depression, 64.6% experienced anxiety and 29.2% experienced stress. In a similar vein, a study conducted in Universiti Teknologi MARA (UiTM) in Selangor by Ibrahim and Alexius (2023) indicated that 49% of health sciences students and 41% of accountancy students experienced anxiety.

According to earlier research, social support, substance misuse, sleep patterns, physical activity (PA), and nutrition are all aspects of a healthy lifestyle that may predict mental health (Sheldon et al., 2021; Plotnikoff et al., 2019; Hervás et al., 2018). Undergraduate students' habits may change as a result of the move from home to university life. This may have an impact on their use of substances, peer connections, sleep patterns, nutrition, and physical activity, all of which can have an effect on their mental health. Notably, sleep is essential for maintaining both mental and physical well-being. Sufficient quality sleep is commonly linked to a healthy lifestyle. It was reported that normal adults require between 7 to 9 hours of sleep per day (Hirshkowitz et al., 2015). In recent years, studies have linked poor sleep to mental health issues, including anxiety and depression. These findings indicate a reciprocal relationship between the two; while bad sleep quality can negatively impact mental health, good sleep quality can enhance it. However, for university students, different factors, including lifestyle changes, academic routines, and extracurricular activities, typically cause poor sleep quality. All of which could have a severe impact on their mental health and learning experience (Saat et al., 2020).

Nurismadiana and Lee (2018) found that 70.6% of undergraduates at Malaysian public universities reported having poor sleep quality. There are great concerns about this group's high prevalence of poor sleep quality, as it affects both their mental health and their capacity to learn. Inadequate sleep quality may also raise the risk of other health-related behaviours, such as eating late and spending more time in front of a computer. Aside from sleep, prior studies have also found a correlation between diet and mental health and stipulated the influence of diet on the onset of mental health symptoms (Lakhan & Vieira, 2008; Kroes et al., 2014). Low vitamin D intake has been linked to increased incidences of schizophrenia and depression (Eyles et al., 2013), while zinc and folic acid deficiencies are linked to depression symptoms (Grajek et al., 2022). Conversely, it has been demonstrated that adequate vitamin D intake reduces the intensity of depressive symptoms in teenagers (Brouwer-Brolsma et al., 2015). According to the analysis, eating more fruits and vegetables may help lessen depressive symptoms and psychological issues. Transition to campus life may have an impact on undergraduates' eating patterns and result in psychological and health issues (Sogari et al., 2018; Brown et al., 2014). Studies found that university students typically eat more fast food and high-energy takeout meals, as well as more fatty foods and drinks. This led to inadequate intake of primary food groups, including vegetables, grains, fruits, dairy and animal and plant proteins from poultry, meat, seeds and nuts (Mogeni & Ouma, 2022; Alkazemi, 2019; Supa et al., 2015).

Engaging in physical activity has several advantages, such as enhancing life quality and mental health. It has been widely shown (Mahindru et al., 2023; Shahadan et al., 2022; Tyson et al., 2010) that a healthy lifestyle is strongly associated with mental health (Baz et al., 2023). A study across eight ASEAN nations by Peltzer and Pengpid (2017) found that 49.9% of college students reported low PA, 33.6% with moderate PA, and only 16.6% practised high PA. Furthermore, 31.5% were sedentary. A more recent study by Azhar et al. (2023) reported that 21.6% of students at the Health Campus of Universiti Sains Malaysia in Kelantan, Malaysia, reported low PA. Furthermore, earlier studies found university students spend more than 8 hours daily sitting as they spend time studying, finishing assignments, and participating in lectures, as well as for leisure purposes like watching movies (Castro et al., 2020). Previous findings showed that college students are more likely to lead sedentary lifestyles and, subsequently, higher risk of mental health problems. There is also an abundance of studies linking PA and mental health, including the management and treatment of stress, anxiety, and

depression involving a variety of groups (Singh et al., 2023; McKeon et al., 2022; Pascoe et al., 2020).

Substance abuse is another factor that may influence undergraduate students' mental health. In this regard, studies have found a complicated relationship between substance usage and mental disease. Drug use has been reported to be prevalent among people with mental health disorders, as they use drugs and alcohol to induce feelings of comfort to relief from their illness. The abuse of drugs modifies the body's biological function, impacting behavior, perceptions, emotions, cognition, and general body functioning (Crews et al., 2011). The use of stimulant and hallucinogenic drugs will result in several physiological, biological, and psychological problems, leading to mental illnesses like depression, anxiety, mood disorders, and paranoia. A study by MA & R (2016) linked drug abuse with psychological symptoms like memory loss, restlessness, and emotional instability, as well as physical impairments like liver, stomach, brain, and nerve damage. According to reports, alcohol, legal and illicit substance consumption among university students has been increasing over the years, which has been linked to negative impacts (Welsh et al., 2019). This situation has also been reported in Malaysia. Rodzlan Hasani et al. (2021) found that 5.1% of teenagers were involved in abusing more than 1 substance, while 17.2% used only one drug. Another Malaysian study by Ismail et al. (2022) found that the prevalence of drug use among youths in Malaysia was 3.5%, and the overall incidence of lifetime drug use was 5.5%.

Another factor that may have an impact on undergraduate students' mental health is social support. According to Putra and Muttaqin (2020), social support is defined as the presence, willingness, and concern of people who care for us. Studies have consistently linked high levels of social support with lower levels of stress and an improved ability to manage stress (Cage et al., 2021; Mishra, 2020; Jun et al., 2018). Social support can be obtained from different sources, including friends, family, lecturers, instructors, and other people, as long as they build relationships with one another. In this light, students' enthusiasm for participating in different activities within educational institutions is greatly increased by peer social support. According to numerous studies, having more social support from friends and family is linked to feeling less lonely and a greater degree of life satisfaction (Lee & Goldstein, 2015; Harikandei, 2017). High-quality social support—whether from teachers, family, or peers—is therefore essential for undergraduate students to improve their academic performance and psychological well-being. By providing facilities, addressing housing issues, helping undergraduate students with their academic and financial challenges, and enriching the student support network. Thus, the provision of social support at the university level can ensure students' needs are fulfilled.

There are five components that are closely correlated to healthy lifestyles and undergraduate students' mental health. As prior studies have extensively examined 4 risk factors, namely smoking, poor diet, excessive alcohol consumption, and physical inactivity (Saneei et al., 2016), the present study has considered substance abuse instead of smoking and included social support as an additional factor, in line with its significance in preventing mental health issues. Furthermore, this study used a questionnaire that specifically focused on healthy lifestyles and mental health issues among the target population. According to a review by Dessauvagie et al. (2021), comprehensive mental health services for university students in ASEAN countries are critically needed. Notably, to counter the rising rate of mental health issues among undergraduate students, there is a need to examine mental health and identify the significant predictors contributing to it in order to plan the appropriate interventions. In order to identify the primary predictors that have a significant impact on mental health, it is imperative to ascertain the degree of the connections between these aspects. The current study thus investigates the most important aspects of healthy lifestyles in relation to mental health in Selangor among undergraduate students at UiTM.

METHOD

The current study employed a cross-sectional research design. This study was conducted in UiTM campuses in Selangor Malaysia, and the population consisted of undergraduate students. The participants' healthy lifestyle, which includes PA, substance abuse, a nutritious diet, enough sleep, and social support, was evaluated using an adapted version of the Adolescent Healthy Lifestyle Questionnaire (AHLQ) for mental health among undergraduate students (Ab Rahman et al., 2023). The 22 items that were assessed for the target population's healthy lifestyles in relation to mental health among undergraduate students have been found valid and reliable (Ab Rahman et al., 2023) in evaluating the five elements of such lifestyles.

The first component is physical activity

(PA), which measures the level of one's involvement in physical activities on campus. The second component is substance abuse, measuring the misuse and the frequency of intake of alcohol, drugs, and smoking. Third is diet, which measures sugar, junk food, and fat intake. Sleep quality evaluates the difficulty and distraction of sleep, and the last component is social support, which assesses the support received from peers.

One prevailing aspect is mental health, which was assessed using DASS21 (Musa et al., 2007). Due to its robustness, usefulness, and simplicity of use, the DASS-21 has become more and more popular throughout the world. With 21 items, the DASS-21 is a self-reported questionnaire designed to assess symptoms of stress, anxiety, and depression. The sum of the scores for each mental health issue is then multiplied by two to determine its score. The questionnaires were pre-tested on 66 participants (33 males and 33 females) from the same population as the study to ensure the instruments' reliability. The study found that the questionnaires had adequate internal reliability, with a Cronbach's alpha value of 0.92. As shown in Table I, the levels for depression, anxiety, and stress, can be further divided into 5 subscales- normal, mild, moderate, severe, and extremely severe.

Table 1. Cut-Off Scores for The Mental Health Level.

Subscale	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	≥ 20

For this cross-sectional study, the participants were chosen through random sampling. In this light, the researchers used the population's sampling frame and a table of random numbers. 180 undergraduate students from UiTM campuses in Selangor, ranging between 18 to 30 years old, were chosen. The study adhered to Tabachnick and Fidell's (1996) recommendation that the number of participants (N) should be equal to or larger than 50 + 8M, where M is the number of predictor variables, in order to guarantee that the sample size was sufficient for multiple regression analysis. This indicates that the study's participant count is appropriate and sufficient. In compliance with the Declaration of Helsinki, et-

hical approval was acquired from the UiTM Research Ethics Committee (ED/REC/F/10895).

The inclusion criteria for this study include, participants are undergraduate students in UiTM campuses in Selangor, aged between 18 and 35 years, and in good health. Participants have to be able to understand and fill out the surveys in Malay, participate in the study of their free will and provide their informed permission. Meanwhile, the exclusion criteria are individuals not enrolled as undergraduate students, outside the age range of 18 to 35, have a history of severe mental health conditions or are in poor health. Participants who did not provide informed consent or withdrew after consenting were also excluded from the study. Data was collected through self-administered questionnaires that were distributed physically to each participant.

The percentages and frequencies were obtained through descriptive statistical analyses. The determinants of healthy lifestyle and mental health were identified using multiple regression. Here, the minimal requirements for residuals being normal, linear, and homoscedastic, as well as the lack of multicollinearity were considered (Carlos et al., 2013; Pallant, 2016). First, the outliers were identified using the standard residual. Outliers are present if the standard residual is more than ± 3.3, according to Tabachnick and Fidell (2013). With the standard residual falling between -2.2 and 3.2, the results demonstrated that there are no outliers in the data. Skewness and kurtosis were then used to determine the normality of data distributions. Each item's skewness and kurtosis illustrate values that are within the acceptable range of < 3 and < 10, respectively (Kline, 2011). Moreover, partial correlation was used to determine the multicollinearity issue. Notably, multicollinearity issues will occur when there is a strong correlation between the predictor variables, r = 0.90. There was no multicollinearity issue found as indicated by the correlation among the predictor variables, which is less than r = 0.90. The standard residual ranged between -2.2 and 3.2, which falls within ± 3.3, indicating no outliers in the data.

RESULT AND DISCUSION

The participants' demographic data are shown in Table 2. The study's participants comprised 180 randomly selected undergraduate students from UiTM campuses in Selangor. The participants were year 1 to year 4 students. In terms of gender, a majority (N=94) was female, and 86 were male.

Table 2. Demographic Data

		N = 180	Percentage
	Faculty of Education	28	15.5
	College of Computing, Informatics, and Media	23	12.7
	Faculty of Health Science	20	11.1
	Faculty of Dentistry	18	10
Faculty/ College	Faculty of Medicine	17	9.4
	College of Creative Art	19	10.5
	Faculty of Business and Management	20	11.1
	Faculty of Accountancy	18	10
	Faculty of Hotel and Tourism Management	17	9.4
Gender	Male	86	47.7
	Female	94	52.2
	1	50	27.7
Year of Study	2	48	26.6
	3	44	24.4
	4	38	21.1
Age	18 - 20	19	10.7
	21 - 23	89	50.3
	24 - 26	67	37.9
	27 - 29	1	.6
	33	1	.6

Table 3 presents the scores for the five variables of healthy lifestyle components-physical activity (PA), healthy diet (HD), sleep quality (SQ), social support (SS) and substance abuse (SA). The results from the descriptive analysis indicate that first, the participants demonstrated a moderate level of physical activity (M = 16.69, SD = 5.48) and a moderate degree of dietary health (M=18.27, SD=4.44). SQ (M=9.52, SD=3.39), poor quality of sleep, moderate levels of social support (M=14.82, SD=4.31) and moderate level of substance abuse (M=10.69, SD=2.90).

Table 3. Descriptive Statistics for Variables Related to Health Lifestyle

Variable	N	Mean	SD
Physical Activity	180	16.69	5.48
Healthy Diet	180	18.27	4.44
Sleep Quality	180	9.52	3.39
Social Support	180	14.82	4.31
Substance Abuse	180	10.69	2.90

Table 4 presents the results of the DASS-21 scale. The scores for depression, anxiety, and stress were categorized into several groups based on their frequency. Scores ranging from 'normal' to 'mild' indicate that the participants are not experiencing any mental health issues, and scores ranging from moderate to severe to extremely severe indicate that the participants are experiencing different levels of mental health issues.

Table 5 illustrates the mental health issues prevalence among the study's participants. The study found that Year 1 students are more prone to depression and anxiety, with 44% and 36% of Year 1 participants reporting experiencing depressive and anxiety symptoms. This number decreased for year 2 and 3 participants, with 27% of them experiencing depression and 22.7% of them experiencing anxiety. The number differs slightly for year 4 participants, where 21% and 23.6% experience depression and anxiety symptoms, respectively. Furthermore, year 2 participants reported a high prevalence of stress at 43.7%, and this is closely followed by year 1 students at 42%, year 3 students at 36.3% and year 4 students at 31.5%.

The multiple regression results for the 180 participants are presented in Table 4. The study found that healthy diet (β = .32, p < .05), PA (β

Table 4. Prevalence of Depression, Anxiety, And Stress Among Students

Year of Study	1 N=50		2 N=48		3 N=44		4 N=38	
Subscale Depression	N	%	N	%	N	%	N	%
Normal	15	30	20	41.6	15	34.0	13	34.2
Mild	13	26	15	31.2	19	43.1	17	44.7
Moderate	12	24	6	12.5	5	11.3	5	13.1
Severe	7	14	4	8.33	3	6.81	2	5.26
Extremely severe	3	6	3	6.25	2	4.54	1	2.63
Anxiety								
Normal	21	42	21	43.7	18	40.9	18	47.3
Mild	11	22	14	29.1	16	36.3	11	28.9
Moderate	8	16	5	10.4	5	11.3	5	13.1
Severe	7	14	4	8.33	3	6.81	3	7.89
Extremely severe	3	6	4	8.33	2	4.54	1	2.63
Stress								
Normal	15	30	11	22.91	17	38.6	15	39.4
Mild	14	28	16	33.3	11	25	11	28.9
Moderate	11	22	14	29.1	12	27.2	9	23.6
Severe	8	16	5	10.4	3	6.81	1	2.63
Extremely severe	2	4	2	4.16	1	2.27	2	5.26

Table 5. The Predictors of Healthy Lifestyle and Mental Health.

Model	ANOVA		Unstandardized Coefficients		Standardized Coefficients			
	F	P-value	Beta	Std. Error	Adj Beta	T	P-value	Adj R²
(Constant)	58.602	.000[b]	73.685	4.353		16.926	.000	.247
Healthy Diet			-1.774	.232	-.501	-7.655	.000	
(Constant)	35.626	.000[c]	75.762	4.301		17.617	.000	.282
Healthy Diet			-1.219	.288	-.344	-4.237	.000	
Physical Activity			-.730	.234	-.253	-3.119	.002	
(Constant)	26.409	.000[d]	69.784	4.898		14.248	.000	.302
Healthy Diet			-1.305	.286	-.369	-4.566	.000	
Physical Activity			-.690	.231	-.240	-2.984	.003	
Sleep Quality			.724	.297	.155	2.439	.016	
(Constant)	22.058	.000[e]	76.946	5.582		13.785	.000	.324
Healthy Diet			-.916	.320	-.259	-2.862	.005	
Physical Activity			-.728	.228	-.253	-3.191	.002	
Sleep Quality			.788	.293	.169	2.689	.008	
Substance Abuse			-.642	.252	-.189	-2.547	.012	

= .23, p < .05), sleep quality (β = .29, p < .05) and substance abuse (β = .25, p < .05) can predict mental health. The four predictor variables contribute 34% of the variance in mental health (r = .58). Moreover, it was found that healthy diet (β =. -.50, p < .05) contributes 25 % (r =.50) variances in mental health [F (1,75) = 242.88, p < .05], while a combination of two variables, healthy diet (β = .34, p < .05) and PA (β = -.25, p < .05), contribute 29 % of the variance in mental health (r = .54). When three variables, healthy diet (β = -37, p < .05), PA (β = -.24, p < .05) and sleep quality (β = .16, p < .05) are combined, they contribute 31 % of the variance in mental health (r = .56). Meanwhile, when the four variables healthy diet (β = -. 26, p < .05), PA (β = -.25, p < .05), sleep quality (β = .17, p < .05), and substance abuse (β = -.19, p < .05) are combined, they contribute to 34 % of the variance in mental health (r = .58). From the analysis, it can be deduced that there are four significant predictors for UiTM undergraduate students' mental health, which are health diet, physical activity, substance abuse and sleep quality. Meanwhile, one predictor, social support, is not a significant predictor of mental health among these students.

This study aims to identify the predictors of healthy lifestyle components that can influence the mental health of undergraduate students at UiTM, Selangor. The study found 4 healthy lifestyle components significantly influence mental health: a healthy diet, physical activity, sleep quality, and substance abuse. Surprisingly, the study found that social support is not a significant predictor of mental health despite previous studies that found links between social support and mental health (House et al., 1988; Coyne & Downey, 1991; Shao et al., 2020). These results might be explained by the high rate of mental health problems among first-year students. In this regard, year 1 students are typically more reliant on family support rather than peer support as they are still in their transition period between high school and university.

The results of this study are consistent with McLean et al. (2022), who asserted that family support is more crucial than peer support for undergraduates in the first year of university as they adjust to the university environment. Moreover, according to Kovess-Masfety et al. (2016) while undergraduate students still depend on their parents for support, nevertheless, they need to become independent gradually. In a similar vein, Arias-de la Torre et al.'s (2019) study emphasized the importance of family support in preventing undergraduate students' mental health problems.

The findings showed that psychological distress among people of both genders will rise as family support declines. This implies that family assistance is essential in supporting first-year undergraduate students in managing their physical and emotional well-being. In this regard, family support is crucial in helping students build new friendships in university.

As mentioned, the study found a healthy diet, physical activities, quality of sleep, and substance abuse are significant predictors of mental health. The most significant factor is a healthy diet, which is in line with past studies (Pereira et al., 2024; Pedroni et al., 2024; Jin et al., 2022; Kilani et al., 2020; Widyasari & Turnip, 2019) that found a healthy diet as a significant factor of a healthy lifestyle and that it impacts mental health. Solomou et al. (2022)'s systematic review found a substantial number of studies linking good diet quality and mental health. Studies reviewed suggested that people who consume more high-quality food like fish, nuts, vegetables and fruits have lower incidences of mental health issues. On the other hand, people who consume inflammatory agent foods such as processed meat, refined carbohydrates, desserts, and sweetened drinks are more prone to symptoms of mental health issues. It could be concluded that maintaining a healthy diet for both physical and mental health is essential. Inadequate dietary intake has been found to have a detrimental impact on mental health issues, especially in the context of anxiety, depression, and stress (Suárez-López et al., 2023).

Excessive sugar consumption can have adverse effects on adolescents' mental health. A study conducted in Oslo, Norway, involving 5,498 teenagers, discovered a significant correlation between soft drink consumption and mental health issues (Lien et al., 2006). Regularly eating junk food, fast food, and diets heavy in fat, sugar, cholesterol, trans fats, and carbohydrates has been shown to have detrimental effects on mental health, particularly on stress and anxiety (Costa & Brody, 2013; Palacios et al., 2020; Granero, 2022). Excessive intake of nuts can also create phytoestrogens, which can alter hormone levels like estrogen and testosterone, leading to stress (Costa & Brody, 2013). Eating a balanced diet can reduce body fat, enhance mental health, and improve brain functions (Sumen & Evgin, 2022). This highlights the importance of nutritious food consumption to maintain an optimal body weight. Having an ideal body weight may enhance mental health by boosting confidence and self-esteem in all demographics, including undergraduate students. Oftedal et al. (2020) furt-

her asserted that eating foods rich in prebiotics, probiotics, and antioxidants, including fruits and vegetables, can increase the effectiveness of anti-depressants in the diet.

The accessibility of fast food on university campuses can alter undergraduates' eating habits and lifestyles. This is because university campuses are surrounded by cafes, restaurants, and fast-food chains. Their eating habits may be impacted by this exposure to fast foods. Hence, the university's nutrition policy should be reviewed to ensure that it promotes the consumption of healthy food and to raise students' awareness of healthy eating through health promotion activities. The current study's findings are also in line with Singh et al.'s (2023) research, which found that PA helps those with mental health conditions experience less psychological discomfort, anxiety, and sadness. Additionally, children and adolescents who receive PA treatments experience fewer symptoms of depression and PTSD (Wegner et al., 2020; Biddle et al., 2019). Regular PA has been demonstrated to lessen depression through a number of mechanisms, including enhanced neurotrophic factor expression, enhanced serotonin and norepinephrine availability, regulation of hypothalamic-pituitary-adrenal axis activity, and reduced systemic inflammation (Gujral et al., 2017). According to a critical review by Alexandratos et al. (2012), weight training, jogging, cycling, and walking can all improve mental health. Furthermore, all types of PA—aerobic, resistance, mixed-mode, and yoga—benefit mental health, according to a systematic study by Singh et al. (2023). However, the advantages to mental health may vary depending on the type of PA, exercises, volume, and intensity. Notably, it was found that low-intensity exercise might not be sufficient to trigger the hormonal and neurological alterations linked to lowering anxiety and depression (Arent et al., 2020). Clough et al. (2016) discovered that even 15 minutes of PA per day can reduce the risk of anxiety and depression by 26%. Yoga and other mind-body practices were the best at lowering anxiety, while resistance exercise also had the biggest effect on depression. According to Singh et al. (2023), moderate-intensity and high-intensity PA are more advantageous than lower-intensity workouts. Therefore, participating in any type of physical activity, such as strength and resistance training or aerobic exercises, for at least fifteen minutes may benefit mental health in a number of ways, including improving mood, focus, emotional stability, and self-esteem, and ultimately increasing the level of positive mental health. Therefore, physical activity is cru-

cial for preventing mental health problems. On the other hand, undergraduate students' involvement in PA may be impacted by lifestyle changes. Increased use of online games and activities may result from the development of various technologies and electronic gadgets. Some undergraduate students tend to lead a sedentary lifestyle due to excessive screen time from using mobile devices, television, personal computers, and social media.

Another significant factor is sleep quality. This finding is also supported by earlier research (Wang et al., 2023; João et al., 2018). The current study's findings corroborate those of a previous study (Scott et al., 2017) that showed poor sleep quality was associated with a number of mental health conditions, such as eating disorders, psychosis, and post-traumatic stress disorder. Poor sleep quality, including sleep deprivation and irregular sleep patterns, can have an adverse effect on mental health as well as the immunological and endocrine systems (Peltzer & Pengpid, 2015). Numerous mood disorders, such as anxiety, obsessive-compulsive disorders, and depression, have long been linked to immune system imbalances (Shultz et al., 2012). Another main issue facing undergraduate students is sleep deprivation, which can be caused by a number of things, such as extracurricular activities, academic work, part-time employment, working while studying, social media, and internet use that can affect sleep duration and, subsequently, their mental health.

Finally, the study found that substance abuse is a predictor of a healthy lifestyle that affects undergraduate students' mental health. It has been acknowledged that substance addiction plays a role in mental health problems. The study's findings support those of subsequent research (Obosi et al., 2022; Mofatteh, 2020; Linden & Jurdi-Hage, 2017). Due to its addictive qualities, alcohol is frequently consumed by undergraduate students, which might result in addiction issues (Limone & Toto, 2022).

Furthermore, tobacco use is a risk factor for substance abuse and is very common among male students, especially those who smoke in social settings. Because social smokers are less likely to stop and may continue their habit, this smoking habit is directly linked to social anxiety disorder (Cai et al., 2017). Peer pressure, academic strain, housing concerns, and financial difficulties can all contribute to mental health issues, and students may use illegal drugs, tobacco, or excessive drinking as a coping strategy, which can exacerbate mental health conditions, including depression and anxiety.

CONCLUSION

The study offers evidence that should be considered by relevant parties in creating awareness of healthy lifestyles among university students. Interventions should be made to improve undergraduate students' physical and mental health to ensure their well-being. The findings showed that the most significant predictors of mental health among the target population are substance abuse, sleep quality, PA, and a healthy diet. Notably, each factor should be taken into account to promote good mental health. For instance, relevant parties should increase access to nutritious food to counter the consumption of junk food, improve sports facilities, and include a social support network comprising peers, parents, and lecturers to help these students face challenges in their daily lives. Additionally, meeting the basic needs of students in relation to healthy lifestyles can facilitate a healthy campus and foster a positive university environment. The fulfilment of these needs can help students lead more fulfilling lives on campus. Students who receive a lot of support from their university tend to have better mental well-being and live healthier.

In terms of its limitation, the first is that the current study's generalizability to the entire population of undergraduates in Malaysia is limited because it did not include all undergraduate students in Malaysia. It only involved participants from UiTM campuses in Selangor. In addition, the current study only included five healthy lifestyle predictors, including lifestyle, psychological, physiobiological, social, and academic risk factors; it should be noted additional predictors migth need to be considered to gather comprehensive data on mental health. Consequently, in order to further understand the factors that predict improving mental health among undergraduate students, future studies could include more participants from other universities in Malaysia and consider other relevant factors that may be of interest to other researchers. Our results' congruence with existing literature highlights the significance of carefully examining the connections between healthy lifestyle predictors like sleep patterns and sleep issues among young adults' mental health and wellness from a public health perspective.

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REFERENCES

Ab Rahman, Z., Isa, B., Shahibi, M. S., & Mansor, M. I. (2023). Exploratory factor analysis of items for evaluating healthy lifestyles related to mental health among undergraduate students. *Malaysian Family Physician, 18*, 62. https://doi.org/10.51866/oa.448

Alexandratos, K., Barnett, F., & Thomas, Y. (2012). The Impact of Exercise on the Mental Health and Quality of Life of People with Severe Mental Illness: A Critical Review. *British Journal of Occupational Therapy, 75*(2), 48–60. https://doi.org/10.4276/030802212x13286281650956

Alkazemi, D. (2019). Gender differences in weight status, dietary habits, and health attitudes among college students in Kuwait: A cross-sectional study. *Nutrition and Health, 25*(2), 026010601881741. https://doi.org/10.1177/0260106018817410

Arent, S. M., Walker, A. J., & Arent, M. A. (2020). *The Effects of Exercise on Anxiety and Depression.* Handbook of Sport Psychology, 872–890. https://doi.org/10.1002/9781119568124.ch42

Arias-de la Torre, J., Fernández-Villa, T., Molina, A. J., Amezcua-Prieto, C., Mateos, R., Cancela, J. M., Delgado-Rodríguez, M., Ortíz-Moncada, R., Alguacil, J., Redondo, S., Gómez-Acebo, I., Morales-Suárez-Varela, M., Blázquez Abellán, G., Jiménez Mejías, E., Valero, L. F., Ayán, C., Vilorio-Marqués, L., Olmedo-Requena, R., & Martín, V. (2019). Psychological Distress, Family Support and Employment Status in First-Year University Students in Spain. *International Journal of Environmental Research and Public Health, 16*(7), 1209. https://doi.org/10.3390/ijerph16071209

Azhar, S., Divya Vanoh, & Keerthana Sree Ganggaya. (2023). Food Choice Motives, Physical Activity Level and Body Mass Index Status Among Undergraduates Students: A Cross-sectional Study. *Malaysian Journal of Medicine and Health Sciences, 19*(6), 151–156. https://doi.org/10.47836/mjmhs.19.6.20

Baz, S. S. B., Malibarey, W. M., Alsalmi, H. A., Alzaydi, M. D., Alqahtani, A. M., & Alghamdi, R. Y. (2023). The Impact of a Healthy Lifestyle on Psychological Well-Being Among Saudi Adolescent Girls Attending Secondary Schools in Taif City, Saudi Arabia. *Cureus, 15*(12). https://doi.org/10.7759/cureus.50189

Biddle, S. J. H., Ciaccioni, S., Thomas, G., & Vergeer, I. (2019). Physical Activity and Mental Health in Children and adolescents: an Updated Review of Reviews and an Analysis of Causality. *Psychology of Sport and Exercise, 42*(42), 146–155. https://doi.org/10.1016/j.psychsport.2018.08.011

Brouwer-Brolsma, E. M., Dhonukshe-Rutten, R. A. M., van Wijngaarden, J. P., van der Zwaluw, N. L., Sohl, E., In't Veld, P. H., van Dijk, S.

C., Swart, K. M. A., Enneman, A. W., Ham, A. C., van Schoor, N. M., van der Velde, N., Uitterlinden, A. G., Lips, P., Feskens, E. J. M., & de Groot, L. C. P. G. M. (2015). Low vitamin D status is associated with more depressive symptoms in Dutch older adults. *European Journal of Nutrition, 55*(4), 1525–1534. https://doi.org/10.1007/s00394-015-0970-6

Brown, J. S. L. (2018). Student mental health: some answers and more questions. *Journal of Mental Health, 27*(3), 193–196. https://doi.org/10.1080/09638237.2018.1470319

Brown, O. N., O'Connor, L. E., & Savaiano, D. (2014). Mobile MyPlate: A Pilot Study Using Text Messaging to Provide Nutrition Education and Promote Better Dietary Choices in College Students. *Journal of American College Health, 62*(5), 320–327. https://doi.org/10.1080/07448481.2014.899233

Cage, E., Jones, E., Ryan, G., Hughes, G., & Spanner, L. (2021). Student mental health and transitions into, through and out of university: student and staff perspectives. *Journal of Further and Higher Education, 45*(8), 1–14. https://doi.org/10.1080/0309877x.2021.1875203

Cai, D., Zhu, M., Lin, M., Zhang, X. C., & Margraf, J. (2017). The Bidirectional Relationship between Positive Mental Health and Social Rhythm in College Students: A Three-Year Longitudinal Study. *Frontiers in Psychology, 8*, 1119. https://doi.org/10.3389/fpsyg.2017.01119

Carlos, M., Gomez, A., Dason Kurkiewicz, G., Williams, M., Grajales, Carlos, A., Gomez, & Kurkiewicz. (2013). Assumptions of Multiple Regression: Correcting Two Misconceptions. *Practical Assessment, Research, and Evaluation, 18*(11), 11. https://doi.org/10.7275/55hn-wk47

Castro, O., Bennie, J., Vergeer, I., Bosselut, G., & Biddle, S. J. H. (2020). How Sedentary Are University Students? A Systematic Review and Meta-Analysis. *Prevention Science, 21*(1). https://doi.org/10.1007/s11121-020-01093-8

Clough, P., Houge Mackenzie, S., Mallabon, L., & Brymer, E. (2016). Adventurous Physical Activity Environments: A Mainstream Intervention for Mental Health. *Sports Medicine, 46*(7), 963–968. https://doi.org/10.1007/s40279-016-0503-3

Costa, R. M., & Brody, S. (2013). Immature psychological defense mechanisms are associated with greater personal importance of junk food, alcohol, and television. *Psychiatry Research, 209*(3), 535–539. https://doi.org/10.1016/j.psychres.2013.06.035

Coyne, J. C., & Downey, G. (1991). Social Factors and Psychopathology: Stress, Social Support, and Coping Processes. *Annual Review of Psychology, 42*(1), 401–425. https://doi.org/10.1146/annurev.ps.42.020191.002153

Crews, F. T., Zou, J., & Qin, L. (2011). Induction of innate immune genes in brain create the neurobiology of addiction. *Brain, Behavior, and Immunity, 25*(1), S4–S12.

Dessauvagie, A. S., Dang, H.-M., Nguyen, T. A. T., & Groen, G. (2021). Mental Health of University Students in Southeastern Asia: A Systematic Review. *Asia Pacific Journal of Public Health, 34*(2-3), 101053952110555. https://doi.org/10.1177/10105395211055545

Dinis, J., & Bragança, M. (2018). Quality of Sleep and Depression in College Students: A Systematic Review. *Sleep Science, 11*(4), 290–301. https://doi.org/10.5935/1984-0063.20180045

Eyles, D. W., Burne, T. H. J., & McGrath, J. J. (2013). Vitamin D, effects on brain development, adult brain function and the links between low levels of vitamin D and neuropsychiatric disease. *Frontiers in Neuroendocrinology, 34*(1), 47–64. https://doi.org/10.1016/j.yfrne.2012.07.001

Grajek, M., Krupa-Kotara, K., Białek-Dratwa, A., Sobczyk, K., Grot, M., Kowalski, O., & Staśkiewicz, W. (2022). Nutrition and mental health: A review of current knowledge about the impact of diet on mental health. *Frontiers in Nutrition, 9*(943998). https://doi.org/10.3389/fnut.2022.943998

Granero, R. (2022). Role of Nutrition and Diet on Healthy Mental State. *Nutrients, 14*(4), 750. https://doi.org/10.3390/nu14040750

Gujral, S., Aizenstein, H., Reynolds, C. F., Butters, M. A., & Erickson, K. I. (2017). Exercise effects on depression: Possible neural mechanisms. *General Hospital Psychiatry, 49*(49), 2–10. https://doi.org/10.1016/j.genhosppsych.2017.04.012

Harikandei, H. R. (2017). Relationship between Perceived Social Support, Mental Health and Life Satisfaction in MSc Students of Physical Education. *International Journal of Sports Science, 7*(4), 159–162.

Hervás, G., Ruiz-Litago, F., Irazusta, J., Fernández-Atutxa, A., Fraile-Bermúdez, A., & Zarrazquin, I. (2018). Physical Activity, Physical Fitness, Body Composition, and Nutrition Are Associated with Bone Status in University Students. *Nutrients, 10*(1), 61. https://doi.org/10.3390/nu10010061

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Katz, E. S., Kheirandish-Gozal, L., Neubauer, D. N., O'Donnell, A. E., Ohayon, M., Peever, J., Rawding, R., Sachdeva, R. C., Setters, B., Vitiello, M. V., Ware, J. C., & Adams Hillard, P. J. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health, 1*(1), 40–43. https://doi.org/10.1016/j.sleh.2014.12.010

House, J., Landis, K., & Umberson, D. (1988). Social relationships and health. Science, 241(4865), 540–545. https://doi.org/10.1126/science.3399889

Ibrahim, W. N. A., & Alexcius, N. (2023). Anxiety and Depression among University Students during the COVID-19 Pandemic: A Cross-sec-

tional Study. *Asian Journal of University Education, 19*(1), 170–179. https://doi.org/10.24191/ajue.v19i1.21224

Ismail, Z., Daud, A., Mohd Zulkefli, N. A., Hod, R., M Yunus, R., Wee, C. X., Baharom, A., & Zakaria, N. (2021). The 10th National Public Health Conference on Managing Pandemic, Controlling Endemic, and Preventing Future Endemics Through Public Health Approach. *Malaysian Journal of Public Health Medicine, 21*(Suppl.3). https://doi.org/10.37268/mjphm/vol.21/no.suppl.3/art.1515

Jin, L., Zhang, N., & Zhu, J. (2022). Healthy lifestyle changes and mental health of healthcare workers during the COVID-19 pandemic in China. *Current Psychology.* https://doi.org/10.1007/s12144-022-03562-5

João, K. A. D. R., Jesus, S. N. de, Carmo, C., & Pinto, P. (2018). The impact of sleep quality on the mental health of a non-clinical population. *Sleep Medicine, 46*, 69–73. https://doi.org/10.1016/j.sleep.2018.02.010

Jun, W. H., Yang, J., & Lee, E. J. (2018). The Mediating Effects of Social Support and a Grateful Disposition on the Relationship between Life Stress and Anger in Korean Nursing Students. *Asian Nursing Research, 12*(3), 197–202. https://doi.org/10.1016/j.anr.2018.08.002

Kaur, J., Cheong, S. M., Mahadir Naidu, B., Kaur, G., Manickam, M. A., Mat Noor, M., Ibrahim, N., & Rosman, A. (2014). Prevalence and Correlates of Depression Among Adolescents in Malaysia. *Asia Pacific Journal of Public Health, 26(*5_suppl), 53S62S. https://doi.org/10.1177/1010539514544356

Khairul Azhar, Nur Nadhira and Ibrahim, Muhamad Ariff and A Halim, Mohd Radzi Tarmizi and Shamsuddin, Aida Soraya and Azahari, Nuraniza and A. Malek, Mohd Ahsani (2023) Prevalence of mental health problems among university students and association with body mass index (BMI) and diet quality. *Malaysian Journal of Medicine and Health Sciences, 19* (3), 82-90.

Kilani, H. A., Bataineh, M. F., Al-Nawayseh, A., Atiyat, K., Obeid, O., Abu-Hilal, M. M., Mansi, T., Al-Kilani, M., Al-Kitani, M., El-Saleh, M., Jaber, R. M., Sweidan, A., Himsi, M., Yousef, I., Alzeer, F., Nasrallah, M., Al Dhaheri, A. S., Al-Za'abi, A., Allala, O., & Al-Kilani, L. (2020). Healthy lifestyle behaviors are major predictors of mental wellbeing during COVID-19 pandemic confinement: A study on adult Arabs in higher educational institutions. *PLOS ONE*, 15(12), e0243524. https://doi.org/10.1371/journal.pone.0243524

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (5th ed., pp. 3–427). The Guilford Press.

Kovess-Masfety, V., Leray, E., Denis, L., Husky, M., Pitrou, I., & Bodeau-Livinec, F. (2016). Mental health of college students and their non-college-attending peers: results from a large French cross-sectional survey. *BMC Psychology, 4*(1). https://doi.org/10.1186/s40359-016-0124-5

Kroes, M. C. W., van Wingen, G. A., Wittwer, J., Mohajeri, M. Hasan., Kloek, J., & Fernández, G. (2014). Food can lift mood by affecting mood-regulating neurocircuits via a serotonergic mechanism. *NeuroImage, 84*, 825–832. https://doi.org/10.1016/j.neuroimage.2013.09.041

Lakhan, S. E., & Vieira, K. F. (2008). Nutritional therapies for mental disorders. *Nutrition journal, 7*, 2. https://doi.org/10.1186/1475-2891-7-2

Larson, L. R., Mullenbach, L. E., Browning, M. H. E. M., Rigolon, A., Thomsen, J., Metcalf, E. C., Reigner, N. P., Sharaievska, I., McAnirlin, O., D'Antonio, A., Cloutier, S., Helbich, M., & Labib, S. M. (2021). Greenspace and park use associated with less emotional distress among college students in the United States during the COVID-19 pandemic. *Environmental Research*, 112367. https://doi.org/10.1016/j.envres.2021.112367

Lee, C.-Y. S., & Goldstein, S. E. (2015). Loneliness, Stress, and Social Support in Young Adulthood: Does the Source of Support Matter? *Journal of Youth and Adolescence, 45*(3), 568–580. https://doi.org/10.1007/s10964-015-0395-9

Lien, L., Lien, N., Heyerdahl, S., Thoresen, M., & Bjertness, E. (2006). Consumption of soft drinks and hyperactivity, mental distress, and conduct problems among adolescents in Oslo, Norway. *American journal of public health, 96*(10), 1815–1820. https://doi.org/10.2105/AJPH.2004.059477

Limone, P., & Toto, G. A. (2022). Factors That Predispose Undergraduates to Mental Issues: A Cumulative Literature Review for Future Research Perspectives. *Frontiers in Public Health, 10*(831349). https://doi.org/10.3389/fpubh.2022.831349

Linden, B., & Jurdi-Hage, R. (2017). Examining the Predictors of Mental Health Outcomes Among Undergraduate Postsecondary Students in Canada. *Journal of Social, Behavioral, and Health Sciences, 11*(1). https://doi.org/10.5590/jsbhs.2017.11.1.01

MA, W., & R, S. (2016). Impact of Drug Addiction on Mental Health. *Journal of Mental Disorders and Treatment, 2*(1). https://doi.org/10.4172/2471-271x.1000110

Mahindru, A., Patil, P., & Agrawal, V. (2023). Role of Physical Activity on Mental Health and Well-Being: a Review. *Cureus, 15*(1). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9902068/

McKeon, G., Curtis, J., & Rosenbaum, S. (2022). Promoting physical activity for mental health: an updated evidence review and practical guide. *Current Opinion in Psychiatry, 35*(4), 10.1097/YCO.0000000000000796. https://doi.org/10.1097/YCO.0000000000000796

McLean, L., Gaul, D., & Penco, R. (2022). Perceived

social support and stress: A study of 1st year students in Ireland. International *Journal of Mental Health and Addiction, 21*(21). https://doi.org/10.1007/s11469-021-00710-z

Mishra, S. (2020). Social networks, social capital, social support and academic success in higher education: A systematic review with a special focus on "underrepresented" students. *Educational Research Review, 29*(100307), 100307. https://doi.org/10.1016/j.edurev.2019.100307

Mofatteh M. (2020). Risk factors associated with stress, anxiety, and depression among university undergraduate students. *AIMS Public Health, 8*(1), 36–65. https://doi.org/10.3934/publichealth.2021004

Mogeni, B. K., & Ouma, L. O. (2022). Dietary patterns, behaviours, and their associated factors among university students in coastal Kenya. *Cogent Food & Agriculture, 8*(1). https://doi.org/10.1080/23311932.2022.2132873

Mohammed, H., Hayati, K. S., & Salmiah, M. S. (2016). Coping with depression, anxiety, and stress: A cross-sectional study among Malaysian students in a public university. *IOSR Journal of Dental and Medical Sciences, 15*(11), 83-95.

Musa, R., Mohd Ariff Fadzil, & Zain, Z. (2007). Translation, validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS). *ASEAN Journal of Psychiatry, 8*(2).

Nurismadiana, I., & Lee, K. (2018). Factors Associated with Sleep Quality Among Undergraduate Students At A Malaysian Public University. *International Journal of Public Health and Clinical Sciences, 5*(6). https://doi.org/10.32827/ijphcs.5.6.373

Obosi, A. C., Fatunbi, A. M., & Oyinloye, O. (2022). Peer pressure and substance use as predictors of mental health among in-school adolescents in Nigeria . *Ianna Journal of Interdisciplinary Studies , 4*(1), 1–9. https://iannajournalofinterdisciplinarystudies.com/index.php/1/article/view/81

Oftedal, S., Glozier, N., Holliday, E. G., & Duncan, M. J. (2020). Diet quality and depressive symptoms. Assessing the direction of the association in a population-based cohort study. *Journal of Affective Disorders*, 274. https://doi.org/10.1016/j.jad.2020.05.046

Palacios, O. M., Cortes, H. N., Jenks, B. H., & Maki, K. C. (2020). Naturally occurring hormones in foods and potential health effects. *Toxicology Research and Application, 4*, 239784732093628. https://doi.org/10.1177/2397847320936281

Pallant, J. (2016). *SPSS Survival Manual (6th ed.).* McGraw-Hill.

Pascoe, M., Bailey, A. P., Craike, M., Carter, T., Patten, R., Stepto, N., & Parker, A. (2020). Physical activity and exercise in youth mental health promotion: a scoping review. *BMJ Open Sport & Exercise Medicine, 6*(1), e000677. https://doi.org/10.1136/bmjsem-2019-000677

Pedroni, G., Anne-Linda Camerini, Albanese, E., Amati, R., Amendola, A., Anna Maria Annoni, Granit Baqaj, Kleona Bezani, Buttaroni, P., Anne-Linda Camerini, Anna Paola Caminada, Cattani, E., Alessandro Ceschi, Corna, L., Cristina Corti Fragoso, Crivelli, L., Sofia, D., Giorgio Dal Bo, Gladys Delai Venturelli, & Dordoni, D. (2024). The importance of a healthy lifestyle to prevent mental health problems during crisis situations: evidence from Corona Immunitas Ticino. Zeitschrift Für Gesundheitswissenschaften/*Journal of Public Health.* https://doi.org/10.1007/s10389-024-02263-6

Peltzer, K., & Pengpid, S. (2017). The Association of Dietary Behaviors and Physical Activity Levels with General and Central Obesity among ASEAN University Students. *AIMS Public Health, 4*(3), 301–313. https://doi.org/10.3934/publichealth.2017.3.301

Peltzer, K., & Pengpid, S. (2015). Sleep duration and health correlates among university students. in 26 countries. *Psychology, Health & Medicine, 21*(2), 208–220. https://doi.org/10.1080/13548506.2014.998687

Pereira, L., Henrique Porcatti Walsh, Marilita Falangola Accioly, Patrizzi, J., Carolina, A., Pires, L., Maycon Souza Pegorari, & Aparecida, I. (2024). Healthy lifestyle as predictors of common mental disorder during coronavirus disease. *Revista Da Associacao Medica Brasileira, 70*(1). https://doi.org/10.1590/1806-9282.20231004

Plotnikoff, R. C., Costigan, S. A., Kennedy, S. G., Robards, S. L., Germov, J., & Wild, C. (2019). Efficacy of interventions targeting alcohol, drug and smoking behaviors in university and college students: A review of randomized controlled trials. *Journal of American College Health*, 67(1), 68–84. https://doi.org/10.1080/07448481.2018.1462821

Putra, A. C. M., & Muttaqin, D. (2020). Hubungan Antara Dukungan Sosial dengan Burnout Pada Perawat di Rumah Sakit X. Psikostudia : *Jurnal Psikologi, 9*(2), 82. https://doi.org/10.30872/psikostudia.v9i2.3901

Ravindran, A. V., & da Silva, T. L. (2013). Complementary and alternative therapies as add-on to pharmacotherapy for mood and anxiety disorders: A systematic review. *Journal of Affective Disorders, 150*(3), 707–719. https://doi.org/10.1016/j.jad.2013.05.042

Richert, T., Anderberg, M., & Dahlberg, M. (2020). Mental health problems among young people in substance abuse treatment in Sweden. *Substance Abuse Treatment, Prevention, and Policy, 15*(1). https://doi.org/10.1186/s13011-020-00282-6

Rodzlan Hasani, W. S., Saminathan, T. A., Ab Majid, N. L., Miaw Yn, J. L., Mat Rifin, H., Abd Hamid, H. A., Robert Lourdes, T. G., Ahmad, A., lsmail, H., Rashid, R. A., & Mohd Yusoff, M.

F. (2021). Polysubstance use among adolescents in Malaysia: Findings from the National Health and Morbidity Survey 2017. *PLOS ONE, 16*(1), e0245593. https://doi.org/10.1371/journal.pone.0245593

Saat, N. Z. M., Hanawi, S. A., Farah, N. M. F., Mohd Amin, H., Hanafiah, H., & Selvaraj, T. (2021). Associations of Physical Activity, Sleep Quality and Cardiovascular Risk Factors in University Students. *Sustainability, 13*(21), 11806. https://doi.org/10.3390/su132111806

Saneei, P., Esmaillzadeh, A., Hassanzadeh Keshteli, A., Reza Roohafza, H., Afshar, H., Feizi, A., & Adibi, P. (2016). Combined Healthy Lifestyle Is Inversely Associated with Psychological Disorders among Adults. *PLOS ONE, 11*(1), e0146888. https://doi.org/10.1371/journal.pone.0146888

Scott, A. J., Webb, T. L., Martyn-St James, M., Rowse, G., & Weich, S. (2021). Improving Sleep Quality Leads to Better Mental health: a meta-analysis of Randomised Controlled Trials. *Sleep Medicine Reviews, 60*(60), 101556. https://doi.org/10.1016/j.smrv.2021.101556

Shahadan, S. Z., Bolhan, N. S., & Mohamad Ismail, M. F. (2022). The Association between Physical Activity Status and Mental Wellbeing among Overweight and Obese Female University Students. *3RD WCII, 18*(s19), 80–86. https://doi.org/10.47836/mjmhs.18.s19.13

Shao, M.-F., Chou, Y.-C., Yeh, M.-Y., & Tzeng, W.-C. (2010). Sleep quality and quality of life in female shift-working nurses. *Journal of Advanced Nursing, 66*(7), 1565–1572. https://doi.org/10.1111/j.1365-2648.2010.05300.x

Sheldon, E., Simmonds-Buckley, M., Bone, C., Mascarenhas, T., Chan, N., Wincott, M., Gleeson, H., Sow, K., Hind, D., & Barkham, M. (2021). Prevalence and risk factors for mental health problems in university undergraduate students: A systematic review with meta-analysis. *Journal of Affective Disorders, 287*(1), 282–292. https://doi.org/10.1016/j.jad.2021.03.054

Shultz, L. D., Brehm, M. A., Victor, G.-M. J., & Greiner, D. L. (2012). Humanized mice for immune system investigation: progress, promise and challenges. *Carolina Digital Repository (University of North Carolina at Chapel Hill), 12*(11). https://doi.org/10.17615/yar2-3h52

Singh, B., Olds, T., Curtis, R., Dumuid, D., Virgara, R., Watson, A., Szeto, K., O'Connor, E., Ferguson, T., Eglitis, E., Miatke, A., Simpson, C. E., & Maher, C. (2023). Effectiveness of physical activity interventions for improving depression, anxiety and distress: an overview of systematic reviews. *British Journal of Sports Medicine, 57*(18). https://doi.org/10.1136/bjsports-2022-106195

Sogari, G., Velez-Argumedo, C., Gómez, M., & Mora, C. (2018). College Students and Eating Habits: A Study Using An Ecological Model for Healthy Behavior. *Nutrients, 10*(12), 1–16.

https://doi.org/10.3390/nu10121823

Solomou, S., Logue, J., Reilly, S., & Perez-Algorta, G. (2022). A systematic review of the association of diet quality with the mental health of university students: implications in health education practice. *Health Education Research, 38*(1). https://doi.org/10.1093/her/cyac035

Song, Y., Huang, Y., Liu, D., Kwan, Johnny. S. H., Zhang, F., Sham, P. C., & Tang, S. W. (2008). Depression in college: depressive symptoms and personality factors in Beijing and Hong Kong college freshmen. *Comprehensive Psychiatry, 49*(5), 496–502. https://doi.org/10.1016/j.comppsych.2008.02.005

Suárez-López, L. M., Bru-Luna, L. M., & Martí-Vilar, M. (2023). Influence of Nutrition on Mental Health: Scoping Review. *Healthcare, 11*(15), 2183. https://doi.org/10.3390/healthcare11152183

Sümen, A., & Evgin, D. (2022). A cross-sectional study examining self-reported anthropometric measurements with adolescents' nutrition attitudes, obesity awareness and diet quality indices during the pandemic. *Journal of Pediatric Nursing, 64*, 133–140. https://doi.org/10.1016/j.pedn.2022.01.018

Supa Pengpid, & Peltzer, K. (2015). Dietary health behaviour and beliefs among university students from 26 low, middle and high income countries. *PubMed, 24*(4), 744–752. https://doi.org/10.6133/apjcn.2015.24.4.21

Tabachnick, B. G., & Fidell, L. S. (2013). Using multivariate statistics (6th ed.). Boston Pearson.

Tyson, P., Wilson, K., Crone, D., Brailsford, R., & Laws, K. (2010). Physical activity and mental health in a student population. *Journal of Mental Health, 19*(6), 492–499. https://doi.org/10.3109/09638230902968308

Wang, Y., Guang, Z., Zhang, J., Han, L., Zhang, R., Chen, Y., Chen, Q., Liu, Z., Gao, Y., Wu, R., & Wang, S. (2023). Effect of Sleep Quality on Anxiety and Depression Symptoms among College Students in China's Xizang Region: The Mediating Effect of Cognitive Emotion Regulation. *Behavioral Sciences, 13*(10), 861. https://doi.org/10.3390/bs13100861

Wegner, M., Amatriain-Fernández, S., Kaulitzky, A., Murillo-Rodriguez, E., Machado, S., & Budde, H. (2020). Systematic review of meta-analyses: Exercise effects on depression in children and adolescents. *Frontiers in Psychiatry, 11*(81). https://doi.org/10.3389/fpsyt.2020.00081

Welsh, J. W., Shentu, Y., & Sarvey, D. B. (2019). Substance Use Among College Students. FOCUS, 17(2), 117–127. https://doi.org/10.1176/appi.focus.20180037

Widyasari, D. C., & Turnip, S. S. (2019). Does healthy lifestyle contribute to physical and mental health among University students? *Makara Journal of Health Research, 23*(3), 150–156. https://doi.org/10.7454/msk.v23i3.1155

Wong, J. G. W. S., Cheung, E. P. T., Chan, K. K. C.,

Ma, K. K. M., & Tang, S. W. (2006). Web-based survey of depression, anxiety and stress in first-year tertiary education students in Hong Kong. *The Australian and New Zealand Journal of Psychiatry, 40*(9), 777–782. https://doi.org/10.1080/j.1440-1614.2006.01883.x

Wong, S. M. Y., Chen, E. Y. H., Suen, Y. N., Wong, C. S. M., Chang, W. C., Chan, S. K. W., McGorry, P. D., Morgan, C., van Os, J., McDaid, D., Jones, P. B., Lam, T. H., Lam, L. C. W., Lee, E. H. M., Tang, E. Y. H., Ip, C. H., Ho, W. W. K., McGhee, S. M., Sham, P. C., & Hui, C. L. M. (2023). Prevalence, time trends, and correlates of major depressive episode and other psychiatric conditions among young people amid major social unrest and COVID-19 in Hong Kong: a representative epidemiological study from 2019 to 2022. *The Lancet Regional Health - Western Pacific, 40,* 100881. https://doi.org/10.1016/j.lanwpc.2023.100881