Eating behaviour and lifestyle changes among college students in Malaysia during the Movement Control Order (MCO)

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ABSTRACT

Introduction: COVID-19 lockdown has been linked to alterations in eating behaviour and a sedentary lifestyle. As human-to-human transmission rapidly increased, the Movement Control Order (MCO) was put in place as an attempt to minimise the risk of the virus spreading in the community. This study aimed to determine whether eating behaviour was associated with sleep quality and physical activity among college students in Malaysia during MCO. **Methods:** This was a cross-sectional study among Malaysian students aged between 20 to 34 years old. A simple random sampling method was applied and the participants had to complete an online survey consisting of a validated Dutch Eating Behaviour Questionnaire (DEBQ), Pittsburgh Sleep Quality Index (PSQI), and International Physical Activity Questionnaire–Short Form (IPAQ-SF), distributed via an online platform. **Results:** A total of 370 students participated, with 22.4% emotional eaters, 58.6% external eaters, and 23.0% restrained eaters. In addition, 64.3% had poor sleep quality, while 57.6% claimed to be physically active. However, no correlations were found between all eating behaviour subscales with sleep quality and physical activity. **Conclusion:** More than half of college students presented with external eating behaviours. Early screening and further investigations should be done, especially with the high rate of poor sleepers, to promote and sustain a healthy lifestyle during and beyond COVID-19.

Keywords: COVID-19, eating behaviour, lifestyle, movement control order

INTRODUCTION

The official term the World Health Organization (WHO) issued for the newly discovered respiratory disease was Coronavirus Disease 2019 (COVID-19). COVID-19 is a disease caused by a virus first found in Wuhan, Hubei Province, China, in late December 2019 (WHO, 2020). Since the disease's discovery, it has swiftly spread from China to the rest of the world and the pandemic has not been halted. WHO (2024) reported a cumulative of 61.2 million confirmed cases in South-East Asia from January 2020 to January 2024.

As human-to-human transmission was rapidly increasing and much about the virus remained unknown, on

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March 18, 2020, the Malaysian Prime Minister issued a Movement Control Order (MCO) to minimise virus spread in the community and to lift the burden and exhaustion of the country's health system. Lockdown restrictions were deemed required to halt the pathogen's spread. Throughout the observation period of MCO, outdoor activities were restricted and people were only allowed to go outside for essential purposes such as groceries shopping and medical-related care. Malaysians were also barred from going abroad. Likewise, foreigners were not permitted entry during MCO. Additionally, many sectors unlisted for operation were ordered to close; most employees were told to work from home and students were advised to adapt to online distance learning (ODL). With these sudden lifestyle changes, Malaysians responded with uncertainty when the MCO declaration was made (Azlan *et al.*, 2020).

The new norm amidst the COVID-19 outbreak has contributed to a transformation in everyone's lifestyle. Staying at home, working from home, online distance learning, limited outdoors and social contact, or working several hours under stressful conditions while handling the associated health hazards have substantially affected everyday functioning and sleeping. According to a study conducted in Spain, a combination of dietary changes, low physical activity, and more sedentary behaviour during quarantine was associated with poorer sleep quality (Martínez-de-Quel *et al.*, 2021). At the same time, Wang *et al.* (2020) identified many psychological effects of COVID-19 in China during the early wave of the pandemic, including elevated stress levels. Besides, among young Saudi women, stress has been linked to overeating, whereby many snacks and fast food intakes were significantly associated with higher stress levels (Al-Musharaf, 2020). In a global study of higher education students in Malaysia, it was concluded that poor sleep quality, poor diet, and physical inactivity were associated with stressful event and this affected students' health behaviours (Du *et al.,* 2021).

Eating behaviour is a broad term that includes food choice motives, dietary habits, and eating disorders (Viana & Sinde, 2008, as cited in LaCaille *et al.*, 2013). For example, Freitas *et al.* (2018) defined eating behaviour as psychosocial factors and attitudes associated with food selection. Psychological, societal, cultural, environmental, and economic variables can all be factors that impact or change eating behaviour, which can significantly influence an individual's health (LaCaille *et al.*, 2013). A study among college students in the United States by Son *et al.* (2020) stated that most (26%) reported that their food intake had increased because of COVID-19. The findings were consistent with a study among adults in Poland, where over 43.0% and nearly 52% reported eating and snacking more (Sidor & Rzymski, 2020). A similar trend was reported among Malaysian university students working remotely, whereby increased eating, snacking, cooking, and online food ordering were observed, leading to weight gain (Chen *et al.*, 2021).

Distant online classes owing to COVID-19 and lockdowns were one of the most regularly mentioned difficulties in studies among university students in Malaysia. The most pressing issue was poor internet connection, which interrupted online learning (Chakraborty *et al.*, 2020; Sundarasen *et al.*, 2020). It was particularly startling to learn that some students used their smartphones to attend online classes for six to eight hours daily, contributing to unmanageable stress and other health problems (Sundarasen *et al.*, 2020).

Excessive screen use, according to students, caused stress and disrupted sleep (Chakraborty *et al.*, 2020).

Since the COVID-19 outbreak is still new and ongoing in Malaysia, more research is needed, specifically on eating behaviour and lifestyle changes among Malaysian college students during MCO. Thus, this study was carried out to determine whether eating behaviour assessed with the Dutch Eating Behaviour Questionnaire (DEBQ) was associated with sleep quality and physical activity among the college student population in Malaysia during COVID-19.

MATERIALS AND METHODS

Study population
A quantitative-based cross-sectional study was conducted among college students in Malaysia on eating behaviour, sleep quality, and physical activity during the COVID-19 lockdown/ MCO. Data were collected from June to July 2021, when the COVID-19 outbreak was still ongoing. MCO in Malaysia began on March 18, 2020 and was halted on August 1, 2021. During this period, Malaysians underwent different phases of MCO and SOPs, such as minimal contact with other people and no interstate travelling allowed until full vaccination was implemented. This study involved a population of Malaysian young adults between 20 to 34 years old who were college students residing in Malaysia when the survey was conducted and had access to a smartphone and the internet. Those who practised food restrictions or had food allergies due to illness, such as celiac disease or Inborn Error of Metabolism (IEM), were excluded from this study. Statistics on the young adult population (age 15-64 years), retrieved from the official website of the Department of Statistics Malaysia, was 23.4 million individuals.

Sampling method
The sampling for this study was carried out using probability sampling through a simple random sampling method. A formula by Krejcie & Morgan (1970) was used to determine the sample size for this study. According to the formula, the sample size needed for this study was 384 participants.

Data collection method
Data were collected using a self-reported questionnaire via Google Forms and the link was shared on social media such as WhatsApp, Instagram, Snapchat, Twitter, and Facebook. Using social media platforms gave a higher chance of recruiting random participants as they were used by many, especially college students, who were practising new norms through online distance learning during the pandemic. The participants had to click on the link provided and would be navigated to the Google Form page directly. In addition, a short overview of the study's purpose, an informed consent form, and instructions on answering the questionnaire were provided. Only those who provided their digital consent were directed to the questionnaire. Participants were required to complete four questionnaire sections. Section A consisted of sociodemographic backgrounds such as age, weight, height, nationality, and college. Section B consisted of 33 questions regarding participants' eating behaviour, followed by sections C and D, with 19 questions on sleep quality and seven on physical activity during the COVID-19 lockdown, respectively.

Materials/Tools
The materials/tools used in this study were the English and Malay language versions of the Dutch Eating Behaviour Questionnaire (DEBQ) to assess the participants' eating behaviour, the

Pittsburgh Sleep Quality Index (PSQI) to assess participants' sleep quality, and the International Physical Activity Questionnaire–Short Form (IPAQ-SF) to assess participants' physical activity during COVID-19 lockdown.

Dutch Eating Behaviour Questionnaire (DEBQ)
Eating behaviour was assessed using the validated DEBQ (Subramaniam *et al.*, 2017). This instrument assessed three unhealthy eating behaviours: emotional eating, which is the tendency to cope with negative emotions; restrained eating, which is the tendency to restrict food intake in order to control body weight; and external eating, which refers to the extent to which external cues of food trigger eating episode. It comprised 33 items of a five-point Likert scale: 13 items on emotional eating and ten items each for external and restrained eating. The score ranged from "never" (score 1), "rarely" (score 2), "sometimes" (score 3), "often" (score 4), to "very often" (score 5). The score for each item was added together and further divided by the number of items in the subscale to get an overall score per subscale. Higher scores suggested a higher likelihood of displaying the subscale behaviour and a cut-off score of 3.25 was used to indicate potential emotional, external, or restrained eaters.

Pittsburgh Sleep Quality Index (PSQI)
The participants' sleep quality was assessed using the PSQI (Farah, Teh & Mohd Rasdi, 2019). PSQI collected data on participants' sleep quality from the previous month. It consisted of 19 items divided into seven subscales: one item for sleep quality, two items for sleep latency, one item for sleep duration, three items for sleep efficiency, nine items for sleep disturbance, one item for sleep medication, and two items for daytime dysfunction. In addition, four

items were open-ended questions and the rest were scored through a four-point Likert scale with a range of 0 to 3, where 0 indicated no difficulty and 3 indicated severe difficulty. Finally, the scores for each subscale were added together to generate a PSQI score and poor sleepers were indicated by a cut-off score of more than five. For both healthy and clinical populations with mental and physical health conerns, this measure has shown high reliability and validity (Guo *et al.*, 2016).

International Physical Activity Questionnaire – Short Form (IPAQ-SF)
Physical activity was assessed using the validated IPAQ-SF (Craig *et al.,* 2003). This metric measured the types of physical activity people engaged in daily to calculate the total physical activity in metabolic equivalent (MET)-minutes/week. IPAQ-SF comprised seven open-ended questions requiring participants to recall their physical activity for the last seven days. IPAQ scores were divided into two categories: physically inactive and physically active. Individuals with low levels were categorised as physically inactive and those with moderate and vigorous levels were categorised as physically active. The categories for physically inactive and physically active were divided based on metabolic equivalent scores (MET-minutes/week), which were calculated based on the IPAQ-SF criteria (moderate level = at least 600 MET-minutes/week, vigorous level = at least 1500 MET-minutes/week). Those who did not meet the criteria were categorised as physically inactive. The MET-minutes/week was calculated as MET level x minutes of activity/day x days per week. IPAQ-SF was more feasible and did not put too much burden on the participants to recall their physical activities since it was self-administered.

Table 1. Baseline characteristics of the participants (*N*=370)

Baseline characteristic	n (%)			Mean±SD		
	Male (n=85)	Female (n=285)	Total (N=370)	Male (n=85)	Female (n=285)	Total (N=370)
Age (20-27)				21.8±1.3	21.9±1.2	21.9±1.2
Body mass index (kg/m²)				24.5±7.4	21.6±4.6	22.2±5.5
Residency						
Urban	45 (52.9)	174 (61.1)	219 (59.2)			
Rural	40 (47.1)	111 (38.9)	151 (40.8)			
Living status						
Family	81 (95.3)	274 (96.1)	355 (95.9)			
Friends	0 (0.0)	1 (0.4)	1 (0.3)			
Alone	0 (0.0)	2 (0.7)	2 (0.5)			
Hostel	4 (4.7)	8 (2.8)	12 (3.2)			
Financial status						
Family	37 (43.5)	140 (49.1)	177 (47.8)			
Scholarship	13 (15.3)	28 (9.8)	41 (11.1)			
Loan	31 (36.5)	114 (40.0)	145 (39.2)			
Part-time job	1 (1.2)	3 (1.1)	4 (1.1)			
Full-time job	3 (3.5)	0 (0.0)	3 (0.8)			

Data analysis

Descriptive statistics were presented as frequency and percentage. Data on self-reported body weight and height were used to compute Body Mass Index (BMI). Meanwhile, continuous variables were presented as means and standard deviations. Pearson's Correlation Coefficient was used to analyse the correlations between the independent variable (eating behaviour) and dependent variables (sleep quality and physical activity). IBM SPSS Statistics for Windows Version 20.0 (IBM Corp., Armonk, New York, USA) was used to carry out all statistical analyses of this study. The significance level was set at a standard *p*-value of 0.05, two-tailed.

Ethical approval

Ethical approval for this study was granted by the Universiti Teknologi MARA Research Ethics Committee (UG/MR/567).

RESULTS

Participants' characteristics

A total of 370 participants returned complete forms. As shown in Table 1, 285 participants (77%) were females, while the remaining 85 participants (23%) were male college students, with an average age of 21.9 years and a BMI of 22.2 kg/m². The participants came from both urban and rural areas, with a majority of 219 participants (59.2%) and 151 participants (40.8%), respectively. Most of the students (355 participants, 95.9%) lived with their families and only one participant (0.3%) lived with friends. Mostly, their source of income came from their families (177 participants, 47.8%), and for three participants (0.8%) from a full-time job (see Table 1).

Participants' lifestyle

Table 2 presents the data for each questionnaire used. DEBQ concluded that most participants did not engage in

emotional eating (77.6%) and restrained eating behaviours (77.0%). However, more than half of the participants were external eaters (58.6%). PSQI indicated that 238 (64.3%) participants had poor sleep quality, with an average score of 8.24; the rest, 132 (35.7%) participants, reported good sleep quality, with an average score of 4.11 when a cut-off point of five was used. Finally, IPAQ-SF reported that 213 (57.6%) participants were deemed to be physically active, with an average MET score of 2722.7. The remaining 157 (42.4%) participants were physically inactive, with an average MET score of 183.3. Generally, the physically active and inactive participants seemed not to have a huge difference (see Table 2).

Correlations between eating behaviour with sleep quality and physical activity

In Table 3, the correlation between eating behaviour, which consisted of emotional eating, external eating, and restrained eating, with sleep quality had a *p*-value

of 0.27, 0.39, and 0.93, respectively. For physical activity, *p*-values of 0.26, 0.32, and 0.23 were found, respectively. Both findings showed no significant associations ($p > 0.05$). Pearson correlation analysis also presented a negligible correlation between eating behaviour and sleep quality (see Table 3).

Correlations between eating behaviour with sleep quality components

Table 4 shows the correlations of eating behaviour with sleep quality components. For the emotional eating subscale, only sleep latency ($p < 0.001$), sleep disturbance ($p < 0.05$), and sleep medication usage ($p < 0.05$) components depicted significant results, but with weak correlations. However, other components showed negligible correlations. External eating presented only one significant finding – the sleep duration ($p < 0.05$) component, nevertheless, the Pearson correlation showed a negative correlation. The

Table 2. Participants' eating behaviour, sleep quality, and physical activity level assessed by various questionnaires (*N*=370)

Variable	n (%)			Mean±SD
	Male (n=85)	Female (n=285)	Total (n=370)	
DEBQ subscales				
Emotional eating	22 (25.9)	61 (21.4)	83 (22.4)	3.81±0.05
Non-emotional eating	63 (74.1)	224 (78.6)	287 (77.6)	2.33±0.03
External eating	46 (54.1)	171 (60.0)	217 (58.6)	3.77±0.03
Non-external eating	39 (45.9)	114 (40.0)	153 (41.4)	2.84±0.03
Restrained eating	26 (30.6)	75 (26.3)	101 (27.3)	3.78±0.04
Non-restrained eating	59 (69.4)	210 (73.7)	269 (72.7)	2.32±0.04
PSQI				
Poor sleep quality (>5)	56 (65.9)	182 (63.9)	238 (64.3)	8.24±2.23
Good sleep quality (≤5)	29 (34.1)	103 (36.1)	132 (35.7)	4.11±1.05
IPAQ-SF				
Physically active	53 (62.4)	160 (56.1)	213 (57.6)	2722.7±2704.5
Physically inactive	32 (37.6)	125 (43.9)	157 (42.4)	183.3±193.2

DEBQ: Dutch Eating Behaviour Questionnaire; PSQI: Pittsburgh Sleep Quality Index; IPAQ-SF: International Physical Activity Questionnaire-Short form
IPAQ unit = MET minutes/week

Table 3. Correlations between eating behaviour subscales with sleep quality and physical activity (*N*=370)

Variable	Sleep quality r (p-value)	Physical activity r (p-value)
Emotional eating	0.06 (0.27)	0.06 (0.26)
External eating	0.05 (0.39)	0.05 (0.32)
Restrained eating	-0.01 (0.93)	0.06 (0.23)

restrained eating subscale also revealed no significant results (see Table 4).

DISCUSSION

This study assessed the prevalence of Malaysian college students engaged with eating behaviour subscales, including emotional eating, external eating, restrained eating, sleep quality level, and physical activity during MCO of COVID-19. Generally, the DEBQ emotional eating subscale is widely used to define individuals with emotional eating, which measures an individual's urge to eat under unfavourable emotional states such as stress, boredom, and depression (Frayn & Knäuper, 2017). Emotional eating disorders have been more common during COVID-19 (Al-Musharaf, 2020). Still, the prevalence of emotional eating during COVID-19 among college students ranged from 4.5% to 52.7% in several studies conducted in

central China (Sze *et al.*, 2021). The low range of emotional eaters might be due to the generalisation of the whole college student population in the country since only several provinces in central China were selected for the studies. However, another finding from Che Ladin & Chin (2021) reported a high prevalence of Malaysian adults who experienced emotional eating (54%). Similarly, this study revealed that almost half of the participants (45.7%) presented as emotional eaters. Therefore, the cases of emotional eating among college students in Malaysia were quite high during the COVID-19 lockdown.

Regarding sleep quality in Malaysia, the latest study in 2019 reported that about 45% of adults had poor sleep before the COVID-19 wave hit Malaysia (Farah *et al.*, 2019). The percentage of poor sleepers among adults was considered high even before the pandemic, almost

Table 4. Correlations between sleep quality components with eating behaviour subscales (*N*=370)

Variables	Emotional eating r (p-value)	External eating r (p-value)	Restrained eating r (p-value)
PSQI			
C1 (Subjective sleep quality)	-0.01 (0.86)	0.04 (0.46)	-0.09 (0.07)
C2 (Sleep latency)	0.17 (0.00)*	0.09 (0.08)	0.07 (0.21)
C3 (Sleep duration)	-0.09 (0.08)	-0.11 (0.04)*	-0.04 (0.40)
C4 (Sleep efficiency)	0.02 (0.67)	0.06 (0.27)	-0.02 (0.72)
C5 (Sleep disturbance)	0.11 (0.03)*	0.07 (0.21)	0.10 (0.07)
C6 (Use of sleep medication)	0.10 (0.05)*	0.04 (0.49)	0.07 (0.21)
C7 (Daytime dysfunction)	-0.03 (0.62)	0.04 (0.51)	-0.03 (0.55)

PSQI: Pittsburgh Sleep Quality Index
*$p \leq 0.05$

reaching half. In this study, Malaysian college students labelled as poor sleepers reached 65%, presenting no improvement in terms of sleep quality. In line with other studies, 44.5% of individuals were reportedly poor sleepers and this might be linked to higher levels of stress and anxiety during lockdown (Pérez-Rodrigo *et al.*, 2020; Stanton *et al.*, 2020; Voitsidis, Huang & Xhao, 2020, as cited in Celorio-Sardà *et al.*, 2021). Trabelsi *et al.* (2021) explained that the COVID-19 lockdown resulted in poor sleep quality as the percentage of those who had good sleep quality fell from 61% before the lockdown to 48% after the lockdown. Lifestyle changes during COVID-19, such as isolation and high usage of electronic devices, as well as stressors, such as uncertainty about one's health or financial consequences, have been shown to impact sleep patterns negatively and cause high rates of sleeplessness. Additionally, during the quarantine, participants (college students) spent more time on screens due to online learning, which is closely linked to increased sleep issues. This study on sleep quality showed that COVID-19 might contribute to a high percentage of poor sleepers among college students in Malaysia.

During the COVID-19 lockdown, engagement with physical exercise reduced significantly (Celorio-Sardà *et al.*, 2021; Trabelsi *et al.*, 2021). Nevertheless, this study's participants (57.1%) were physically active. The results were consistent with the latest report in Malaysia, whereby Malaysians were physically active during MCO (Syed Shiekh & Marathamuthu, 2021). In addition, these findings were consistent with the studies conducted in Italy and Spain, where individuals were reported to be more active during lockdown (Di Renzo *et al.*, 2020; López-Bueno *et al.*, 2020, as cited in Ingram, Maciejewski & Hand, 2020). Regardless, the difference between those physically active (57.1%) and inactive (42.9%) were insignificant in this study.

Shen *et al.* (2020) stated that higher levels of perceived stress are linked to a stronger inclination towards emotional eating. A correlation between emotional eating and sleep quality could exist because there is a link between stress with emotional eating and sleep quality. Negative emotions are linked to emotional eating, which may influence sleep quality. In a study by Geiker *et al.* (2017), as cited in Saleh-Ghadimi *et al.* (2019), a link between emotional stress and sleep was presented, which caused the participants with a high emotional eating score to be more prone to poor sleep quality. This was also supported by Dweck *et al.*'s (2014, as cited in Saleh-Ghadimi *et al.*, 2019) study among healthy women in the United States, where poor sleepers had a considerably higher emotional eating score.

To our knowledge, stress increased during the COVID-19 pandemic, which disrupted normal lifestyle. However, despite the evidence linking emotional eating and sleep quality, this study reported no causal relationship between these two variables, whereby the elevation of PSQI scores did not necessarily increase DEBQ scores. This might be due to the different questionnaires used to define emotional eaters compared to previous studies. Besides, when all seven components of sleep quality were analysed with emotional eating, only sleep latency, sleep disturbance, and sleep medication usage were significantly increased with the increasing score of emotional eating. Still, the components did not certainly represent a correlation with emotional eating, as no positive correlations within the range of 0.30 to 1.00 were observed in those three components.

This study's correlation between eating behaviour and physical activity

also revealed no causal relationship. It was likely that individuals in a negative mood experienced lower physical activity, which would match earlier findings of reduced physical activity when people are socially isolated (Robbins *et al.*, 2018; Werneck *et al.*, 2019, as cited in Ingram *et al.*, 2020). Nonetheless, existing research on the effects of stress on physical exercise presented inconsistent findings. This study's result was in line with a statement by Düz & Tuba Aytekeli (2020), in which DEBQ subscales and MET scores had no significant association.

Ingram *et al.* (2020) concluded that relaxing lockdown restrictions result in a rapid boost of positive mood. Here, no more alterations were shown after, as this might be due to the minor differences in lockdown regulations that occurred during the period. The participants were likely to have accommodated to the lockdown situation. Thus, stress due to the COVID-19 lockdown might not be a factor for poor sleep quality and lower physical activity. As a result, a link between eating behaviour, sleep quality, and physical activity was not found.

The strengths of this study would be the sufficient sample of young adult population, which provided a good influence to perform analyses. Besides, this study was also conducted to find the correlation between different variables that could assist in comprehending the existing links and further present us with the realistic situation in today's world. Not to mention, the proportion of participants from urban and rural areas was quite balanced, with minor differences in percentages, which conveyed the generalisation of the study population in Malaysia.

Nevertheless, this study had a couple of limitations to note. Firstly, response bias might have occurred since the survey was self-reported. Participants might have underreported or overreported the data based on their ability to recall. Moreover, the survey form might need to be clearer from the participant's point of view in terms of the instructions given or the format style set for the questions. Next, a longitudinal study would have provided better and more accurate insights than a cross-sectional study to determine the impact of MCO during COVID-19 on the changes in participants' lifestyles. Furthermore, as the study results were more inclined towards female participants, the sample may not be representative. Finally, since the study was conducted during the second half of 2021, whereby most college students had already adjusted to the new norms, the factors affecting participants' lifestyles might have lessen compared to the first half of 2020, when MCO had just started.

CONCLUSION

College students in Malaysia had poor sleep quality during the COVID-19 lockdown. Although there were no correlations between emotional eating with sleep quality and physical activity, findings are still at initial stages since only a few studies have been conducted to assess the relationship between emotional eating using DEBQ scores with PSQI and IPAQ-SF scores. In essence, early screening of college students' lifestyles should be initiated in Malaysia. This is to promote and sustain a healthy lifestyle among college students. Further investigations can help counter the core predictors of eating behaviour, sleep quality, and physical activity during and beyond COVID-19.

Conflict of interest

The authors declare no conflict of interest in this study.

References

Al-Musharaf S (2020). Prevalence and predictors of emotional eating among healthy young Saudi women during the COVID-19 pandemic. *Nutrients* 12(10):2923.

Azlan AA, Hamzah MR, Sern TJ, Ayub SH & Mohamad E (2020). Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PLOS ONE* 15(5): e0233668.

Celorio-Sardà R, Comas-Basté O, Latorre-Moratalla ML, Zerón-Rugerio MF, Urpi-Sarda M, Illán-Villanueva M, Farran-Codina A, Izquierdo-Pulido M & Vidal-Carou M del C (2021). Effect of COVID-19 lockdown on dietary habits and lifestyle of Food Science students and professionals from Spain. *Nutrients* 13(5):1494.

Chakraborty P, Mittal P, Gupta MS, Yadav S & Arora A (2021). Opinion of students on online education during the COVID-19 pandemic. *Hum Behav Emerg Tech* 3:357-365.

Che Ladin RIZ & Chin YS (2021). *Associations of sociodemographic and lifestyle factors with emotional eating among Malaysian adults during the COVID-19 pandemic.* From https://nsm22.s3.ap-southeast-1.amazonaws.com/i6cw1oagn3wmljgd1odrkjwqy13b [Retrieved December 1 2021].

Chen HW, Marzo RR, Anton H, Abdalqader MA, Rajasekharan V, Baobaid MF, Hamzah H, Tang HC & Ads HO (2021). Dietary habits, shopping behavior and weight gain during COVID-19 pandemic lockdown among students in a private university in Selangor, Malaysia. *J Public Health Res* 10(2 Suppl):jphr.2021.2921.

Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund UL, Yngve A, Sallis JF & Oja P (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & science in sports & exercise* 35(8):1381-95.

Du C, Zan MC, Cho MJ, Fenton JI, Hsiao PY, Hsiao R, Keaver L, Lai CC, Lee H, Ludy MJ & Shen W (2021). Health behaviors of higher education students from 7 countries: Poorer sleep quality during the COVID-19 pandemic predicts higher dietary risk. *Clocks & Sleep* 3(1):12-30.

Düz S & Tuba Aytekeli S (2020). Determination the level of physical activity and eating behaviors of university students. *Asian J Educ Training* 6(1):65-71.

Farah NM, Teh SY & Mohd Rasdi HF (2019). Self-reported sleep quality using the Malay version of the pittsburgh sleep quality index (PSQI-M) in Malaysian adults. *Int J Environ Res Public Health* 16(23):4750.

Frayn M & Knäuper B (2017). Emotional eating and weight in adults: A review. *Curr Psychol* 37(4):924-933.

Freitas A, Albuquerque G, Silva C & Oliveira A (2018). Appetite-related eating behaviours: An overview of assessment methods, determinants and effects on children's weight. *Ann Nutr Metab* 73(1):19-29.

Guo S, Sun W, Liu C & Wu S (2016). Structural validity of the pittsburgh sleep quality index in Chinese undergraduate students. *Front Psychol* 7:1126.

Ingram J, Maciejewski G & Hand CJ (2020). Changes in diet, sleep, and physical activity are associated with differences in negative mood during COVID-19 lockdown. *Front Psychol* 11:588604.

Krejcie RV & Morgan DW (1970). Determining sample size for research activities. *Educ Psychol Meas* 30(3):607-610.

LaCaille L, Patino-Fernandez AM, Monaco J, Ding D, Upchurch SCR, Butler CD, Soskolne CL, Gidron Y, Turner JR, Butler J, Burns MN, Mohr DC, Molton I, Carroll D, Critchley H, Nagai Y, Baumann LC & Karel A (2013). Eating behavior. *Encyclopedia of Behavioral Medicine* 641-642.

Martínez-de-Quel Ó, Suárez-Iglesias D, López-Flores M & Pérez CA (2021). Physical activity, dietary habits and sleep quality before and during COVID-19 lockdown: A longitudinal study. *Appetite* 158:105019.

Saleh-Ghadimi S, Dehghan P, Abbasalizad Farhangi M, Asghari-Jafarabadi M & Jafari-Vayghan H (2019). Could emotional eating act as a mediator between sleep quality and food intake in female students? *Biopsychosoc Med* 13:15.

Shen W, Long LM, Shih CH & Ludy MJ (2020). A humanities-based explanation for the effects of emotional eating and perceived stress on food choice motives during the COVID-19 pandemic. *Nutrients* 12(9):2712.

Sidor A & Rzymski P (2020). Dietary choices and habits during COVID-19 lockdown: Experience from Poland. *Nutrients* 12(6):1657.

Son C, Hegde S, Smith A, Wang X & Sasangohar F (2020). Effects of COVID-19 on college students' mental health in the United States: Interview survey study. *J Med Internet Res* 22(9):e21279.

Sundarasen S, Chinna K, Kamaludin K, Nurunnabi M, Baloch GM, Khoshaim HB, Hossain SFA & Sukayt A (2020). Psychological impact of COVID-19 and lockdown among university students in Malaysia: Implications and Policy Recommendations. *Int J Environ Res Public Health* 17(17):6206.

Subramaniam K, Low WY, Chinna K, Chin KF, Krishnaswamy S (2017). Psychometric properties of the Malay version of the Dutch Eating Behaviour Questionnaire (DEBQ) in a sample of Malaysian adults attending a health care facility. *Malays J Med Sci* 24(4):64-73.

Syed Shiekh SF & Marathamuthu S (2021). Behaviour and the perception of physical activity during the period of movement control order (MCO) in Malaysia. *Mal J Mov Health Exerc* 10(1):9-16.

Sze KYP, Lee EKP, Chan RHW & Kim JH (2021). Prevalence of negative emotional eating and its associated psychosocial factors among urban Chinese undergraduates in Hong Kong: A cross-sectional study. *BMC Public Health* 21(1):583.

Trabelsi K, Ammar A, Masmoudi L, Boukhris O, Chtourou H, Bouaziz B, Brach M, Bentlage E, How D, Ahmed M, Mueller P, Mueller N, Hsouna H, Romdhani M, Hammouda O, Paineiras-Domingos L, Braakman-jansen A, Wrede C, Bastoni S & Pernambuco C (2021). Globally altered sleep patterns and physical activity levels by confinement in 5056 individuals: ECLB COVID-19 international online survey. *Biol Sport* 38(4):495-506.

Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS & Ho RC (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 17(5):1729.

WHO (2020). In: *Naming the coronavirus disease (COVID-19) and the virus that causes it.* From https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it [Retrieved March 30 2021].

WHO (2024). In: *WHO COVID-19 dashboard.* From https://covid19.who.int [Retrieved February 1 2024].