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Original Article

Examining the Effects of COVID-19 Movement Control Orders on Malaysian Pharmacy Students' Diet and Lifestyle

Shariza Sahudin, Mumtaz Hussain, Khairunnisa Mohd Salleh, Muhammad Izzudin Zamery

Faculty of Pharmacy, Universiti Technology MARA, Puncak Alam Campus, Selangor, MALAYSIA.

ABSTRACT

Background: The COVID-19 pandemic and its associated movement control orders have directly impacted various supply chains, including food and healthcare. While the early impacts of the pandemic on health have been widely documented, little data exist on how movement restrictions may continue to affect Malaysians after the pandemic responses have changed, evolved, and diminished. Essential questions concerning any continued effect of COVID-19 prevention measures on diet and exercise patterns and the long-term risk of food insecurity on the overall quality of life. This preliminary study aimed to examine any lasting impact of COVID-19 prevention measures on the diet and exercise habits among a small group of university adults in Malaysia. **Materials and Methods:** Two cohorts of Malaysian third-year undergraduate pharmacy students were provided with a questionnaire and a two-day food diary. The questionnaire consisted of four sections to examine demographics, lifestyle, and diet, together with a small section examining knowledge of diabetes. The cohorts were separated in time by the COVID-19 pandemic, specifically the movement control orders associated with the pandemic. **Results:** A total of 226 completed questionnaires were received, 113 from each cohort. Interestingly, 95% of students in the pre-pandemic group consumed fewer calories than adults' recommended intake, with an average daily sugar intake of 36.9g. Within the post-pandemic group, the average daily sugar intake was higher at 41.5g, and fewer students (74%) ate less than the Malaysian recommended intake. Food choices made by students were very similar before and after the pandemic and strongly dictated by their environment, in this case, the university campus, where all students from both cohorts resided. Most participants regularly ate a substantial lunch, which seems to be the most important meal of the day for most in terms of calorie intake. Breakfast and dinner choices were often unsubstantial. Approximately 30% ate breakfast and almost 60% ate dinner. Breakfast usually consisted of white sliced bread and dinner options range from white rice and fried chicken to sliced white bread with water. Participants preferred sweetened drinks to accompany meals, and in most cases, snacks consisted of cakes, biscuits, and crisps. In conclusion, students within both cohorts ate one substantial daily meal for lunch. Breakfast and dinner, in general, demonstrated poor food choices, possibly due to lack of choice. **Conclusion:** The COVID-19 pandemic did not substantially change the trends in eating habits. However, an increase in calorie intake is observed going from the pre-pandemic to the post-pandemic group. Unfortunately, this increase appears to be in the form of sugar and processed foods.

Keywords: COVID-19, Food Insecurity, Diet, Exercise, Lock-down measures.

Correspondence:
Dr. Mumtaz Hussain
Faculty of Pharmacy, Universiti Technology MARA Puncak Alam Campus, Selangor-42300, MALAYSIA.
Email id: mumtaz2332@uitm.edu.my

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INTRODUCTION

On January 25, 2020, the first cases of the novel coronavirus (COVID-19) were identified in Malaysia, and by February 25, this early bout of limited infections had been successfully dealt with through tracking, isolation, and treatment. A religious gathering in late February resulted in a much larger second wave of infections, leading to the country's strict movement control order or MCO. This introduced restrictions to limit the movement of the country's population, including temporary closure of all non-essential businesses and restrictions at the country's borders limiting entry for all non-Malaysians regardless of visa status. The MCO remained in place until April 2022. Between February 2020 and April 2022, however, it became less restrictive as time passed, as the government responded to a fall in the number of infections, and the country's vaccination program moved forward rapidly. Most restrictions, including opening the country's borders, were finally lifted in April 2022. Like other countries, many businesses, including restaurants and eateries, suffered greatly during the MCO, as dine-in services were not permitted, opening hours were restricted to 8 pm, and there was a general reduction in footfall. Many businesses adapted by moving towards delivery and collection services. COVID-19, and the measures necessary

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to prevent its spread, dramatically changed the daily lives of those living not only in Malaysia but globally. Studies have indicated that COVID-19 prevention measures have substantially affected people's eating and exercise routines,[1-3] access to food and food insecurity,[4] and overall quality of life due to the limited ability to visit grocery stores.[5-7] This also may have resulted in individuals changing shopping habits, where many tended to purchase in bulk, stocking up on food, which was likely processed and calorie dense and lacking in nutritional quality.[8,9] Maintaining exercise regimens amid COVID-19 also posed a challenge, as people are less likely to venture outdoors and non-essential businesses such as gyms and fitness centers would also have been closed.[10-12] The changes in dietary and lifestyle habits during the COVID-19 pandemic are of particular concern as healthy diet and exercise habits are essential to preserve a robust immune system and reduce the risk of developing metabolic disease, both of which are important for the prevention of severe COVID-19 and the promotion of long-term health.[13,14]

The COVID-19 pandemic has directly impacted various supply chains, including food and healthcare,[15,16] and Malaysian is no different. The MCO had significantly disrupted the food chain, including the production, distribution, and retailing of agricultural products within the food industry. This, together with consumer panic and bulk buying, caused a challenge for many governments to manage food shortages. While the early impacts of the pandemic on health have been widely documented, little data exist on how these previous restrictions of the MCO may continue to affect Malaysians after the pandemic responses have changed, evolved, and now diminished. Essential questions concerning any continued effect of COVID-19 prevention measures on diet and exercise patterns and the long-term risk of food insecurity on the overall quality of life.

The COVID-19 pandemic has led to a global economic slowdown, leading to higher unemployment and a reduction in people purchasing power. This tends to result in individuals purchasing the cheapest calories possible. Ultimately this may lead to food and nutrition insecurity. Before the onset of the COVID-19 pandemic, about 4.88 million (25.0%) adults in Malaysia were already identified as food insecure. According to the Malaysian Adult Nutrition Survey (MANS), in 2014, 25.5% (4.98 million) of people reported food variety insufficiency, while 21.9% (4.26 million) reported meal size reduction due to financial constraints in the past twelve months. About 4 million children (23.7%) were experiencing food insecurity in terms of reliance on a limited number of cheap foods, and 20.8% (3.5 million) of households reported an inability to feed children with a variety of foods due to financial constraints.[17] The World Food Program forecasted that the COVID-19 pandemic would double the number of people facing food crises unless swift action is taken.[18] Based on the current prevalence of food insecurity, an estimated 9.76 million, or 30% of the Malaysian population is expected to suffer from food insecurity due to the lasting effects of the COVID-19 pandemic.

The end of the COVID-19 pandemic and the winding down in most countries of movement control orders and border restrictions have directly or indirectly led to a lasting effect on the food supply chain. Record-high food prices have triggered a global crisis that will drive millions more into extreme poverty, magnifying hunger and malnutrition while threatening to erase hard-won gains in development. The war in Ukraine, supply chain disruptions, and the continued economic fallout of the COVID-19 pandemic are pushing food prices to all-time highs, and food prices in Malaysia have been no different. Rising food prices significantly impact people in low- and middle-income countries and individuals since they spend a larger share of their income on food than people in high-income countries.

The current preliminary study focuses on two groups of young student adults living away from home in student accommodation, both before and after the MCO was implemented, in an attempt to identify any general and sustained changes in lifestyle and eating habits now that the movement restrictions have ended. During MCO, schools and university teaching activities in Malaysia were conducted online. Students could not travel across state borders, and those who were residing on campus when the MCO was declared could not travel home if traveling meant crossing a state border. This resulted in isolated community bubbles in which those residing within had to adapt to the restrictive movement control orders, exacerbated by the limited availability of facilities and services.

MATERIALS AND METHODS

Study Design

The study population consisted of two groups of third-year UiTM pharmacy students. A total of 159 students (27 male and 132 female) were evaluated before 2020, before any indication of the onset of a global COVID-19 pandemic. Post-pandemic, and after any control orders were lifted, removing the general day-to-day restrictions on movement, a new cohort of 158 students (36 male and 122 female) were also invited to participate in the study. Sample sizes were calculated to be 113 participants for each cohort. Though the two groups of participants are from two different cohorts, the rigorous entry requirements for the program have not changed over time, the all participants are from the same ethnic groups, so it is assumed with similar backgrounds and life experiences. This, of course, will be confirmed by demographic data. The study attempts to identify any changes in trends between the two groups, notwithstanding any inherent differences in terms of personalities, social status, and background. Ethics approval for the study was obtained from the institution's ethics committee REV (PH) / 016/2022.

Materials and Measures

The study used a structured, four-section, validated questionnaire to gain insight into the attitudes toward dietary intake and lifestyle, diet (food diary), and knowledge and awareness of diabetes. The food diary enabled students to track their food consumption over 48 hr, allowing them to report detail about what they ate with an estimate of portion size. Students were given typical examples of portion sizes to help them complete the diary before the study. A 'three-response system' was utilized, with yes, no, and 'not sure' response variables in sections 2, 3, and 4. The 'not sure' response ensures respondents considered all answers. A scoring system was used to assess the responses to the questionnaires, and a scoring system was used in which correct/positive answers were allocated two marks each, 0 marks for negative answers, and one for 'not sure. 'The total score of all three sections was then used to calculate a percentage score for each section and the questionnaire. The high score indicated good attitudes, diet, lifestyle, and knowledge among the respondents. Initial testing of the questionnaire was conducted within a test group of 10 pharmacy students, and the completed questionnaires and answers were validated using a Cronbach alpha test to measure internal consistency and questions amended where appropriate. The inclusion criteria for respondents were Pharmacy students, both male, and female, from third-year cohorts. The exclusion criteria were the students with pre-existing diabetes mellitus type 1 or type 2 and pregnancy.

The first section attempts to gain basic demographic information with questions about gender, age, height, weight, BMI, and health status. The second section focuses on attitudes toward a healthy diet and the importance of an active lifestyle. The third section consisted of a food diary, enabling students to track their food consumption over 48 hr, allowing them to report details of food consumed with an estimate of portion size. Students were provided with typical examples of portion sizes to improve the accuracy of the completed diary. The number of calories for each food and drink consumed by respondents was determined, and the total and average amount of calories per day was determined. The recommended daily calorie intake was determined using the Mifflin-St Jeor formula for daily Calories, using height (cm), weight (kg), gender, age, and lifestyle-determined options for activity (sedentary, lightly active, moderately active, very active, extra active). The extent of physical activity was established as light, moderate or vigorous. A scoring system is used to characterize the frequency of exercise and physical activity as follows; 5 to 7 times per week (5 marks), 3 to 4 times per week (4 marks), 1 to 2 times per week (3 marks), 1 to 3 times per months (2 marks) and none (1 mark). For the time spent in sedentary activities, the scoring system was as follows; < 4 hr (4 marks), 5 to 8 hr (3 marks), 9 to 12 hr (2 marks), and > 12 hr (1 mark). A higher score indicates better physical activity. The fourth and fifth sections dealt with students' knowledge, awareness, and attitude toward diabetes and the role of pharmacists in providing medical and lifestyle advice to diabetic patients and the general population to promote healthy diets and lifestyles. This was included to gauge participants' situational and self-awareness in the context of their degree program and their future roles as pharmacists and diabetes. Lifestyle scores described were determined using the Hoo and Navaratnam,[19] classification.

RESULTS

Demographics

As expected, demographic data (Table 1) revealed similar trends before and after the pandemic as students are from similar backgrounds (most students are of Malay ancestry or indigenous Malaysian background). Entry requirements and entry processes to the pharmacy program have remained consistent throughout the years, bringing a degree of consistency to participant profiles. The data did reveal some interesting statistics concerning overall health and well-being. The educational background of students (not shown) is almost identical, with students completing Malaysian STPM, Matriculation, or Pharmacy Diploma qualifications before entering the pharmacy degree program. The male/female student ratios are similar, a common trend within Malaysian higher education, with a more significant number of female students in higher education and the pharmacy workforce. 26% of students were overweight and obese before the pandemic. Post-pandemic, this figure among the second cohort dropped slightly to 20% but remained similar to those obtained from the Adult Nutrition Survey (MANS) in 2014.[17] where 20.7% of adults were found to be overweight and 5.8% obese. The average age of respondents was relatively young, 22-24 years, and approximately 33-35% of participants revealed a family member with diabetes. Both are considerable risk factors for developing diabetes in the future.

Lifestyle

Recent studies have revealed that approximately 61% of Malaysians are physically inactive,[20] Within the participants, 16% of pre-pandemic respondents (Table 2) exercised three times a week or more. Female students are much less inclined to be physically active, with only 11% being active three times or more, compared with 50% of males. On a positive note, almost 70% of respondents exercised at least once a week. However, from another perspective, 15 % to 17 % of participants undertook no physical activity, though these figures are better than those obtained from recent Malaysia-wide studies, which revealed that 43.7% of adults did not adopt a 'physically active lifestyle'.[21] Focusing on post-pandemic data (Table 3), it is interesting to note that the overall prevalence of physical activity among students came down ever so slightly, as indicated by no respondents exercising 5 -7 times per week, compared with 6.2% overall before the pandemic, mainly comprising of 35% of male participants. Male and female students' remaining physical activity figures

Table 1: Demographic data for participants both pre and post COVID-19 Movement Control Order (MCO).

Characteristics	Number of respondents	Percentage	Number of respondents	Percentage
Gender				
Male	20	17.7	14	12.39
Female	93	82.3	99	87.61
Age				
19 - 21 years old	4	3.5	0	0
22 - 24 years old	105	92.9	110	97.34
25 years old and above	4	3.5	3	2.65
Family member with diabetes				
Yes	38	33.6	40	35.40
No	75	66.4	73	64.60
BMI				
Underweight	21	22.1	18	15.93
Ideal	62	54.9	72	63.72
Overweight	21	18.6	14	12.39
Obese	9	8.0	9	7.96

are very similar pre and post-pandemic. In summary, the trends in physical activity appear to be generally the same both across gender and pre and post-pandemic, with a slight reduction in higher frequency activities.

The estimated calorific intake of students (Table 3 and Table 4), calculated from the information provided within the 2-day food diary, paints a picture of students who generally seem to be consuming much less than the 2000 kcal and 1500 kcal Recommended Nutrient Intake (RNI) for men and women respectively. Admittedly the food diaries provide a very brief snapshot of the student's food intake. However, in general, over 95% (pre-pandemic) and 74% (post-pandemic) of students in the study were consuming fewer calories than recommended. The post-pandemic number was closer to the recent and more accurate Malaysian Adult Nutrition Survey (MANS) in 2014, where 66.5% of the 3000 respondents' calorie intakes were less than the RNI. This study's more significant number of student respondents may have been due to several factors. Firstly, the current study's small size will influence these figures' overall accuracy. The MAN's study recruited 3000 individuals of age 18-59 years. Secondly and more importantly, most individuals cannot or do not provide accurate information about what they eat. Although this detail can apply to both studies, the younger population of the current study may also contribute to the discrepancy. Underestimation of food intake can vary from 10-45% and depend upon age, sex, body composition, and socio-economic status.[22]

The calorie intake of the post-pandemic group of participants was higher than those of the pre-pandemic group, which is consistent for both males and females. As previously mentioned, Malaysians generally consume much less than the 2000 kcal, and 1500 kcal Recommended Nutrient Intake (RNI) for men and women. Participants within this post-pandemic group are no exception. Post-pandemic, there have been an approx. 60 kcal increase (3% RNI) in calorie intake for male participants and a much more significant 260 kcal increase (17% RNI) among females. All things being equal, the slight increase in daily calories may be associated with increased sugar intake, as indicated by the calculated added sugar intake. The average sugar intake of overall participants post-pandemic was 41.47g compared with 36.97g pre-pandemic—a 12% increase. Looking closely, this increase is more significant among female participants, corresponding to an almost 27% increase in sugar intake. In comparison, the sugar intake of male participants has remained similar, pre and post-pandemic, with a much smaller 2.5% increase.

Varying recommendations exist regarding recommended sugar intake; the World Health Organization (WHO) recommendations in 2015 state that the intake of free sugars should not exceed 10% of total energy to prevent chronic disease,[20] A 2000 kcal (male) and 1500 kcal (female) diet translates into 50 grams and 37.5 grams of added sugar per day, respectively. The American Heart Association recommends that the intake of added sugars not exceed 100 calories per day for women and 150 calories per day for men.[23] The 2013 Malaysian Dietary Guidelines include the statement "Consume foods and beverages low in sugar" with general dietary advice on achieving this goal. However, no specific limits are set. Malaysians consume sugar as the second most frequently consumed food item,[24] with an estimated mean intake of 22.21 g. However, these figures account for whole-added sugar consumption and do not include hidden sugars in foods

Table 2: Lifestyle data for participant's pre-COVID-19 pandemic Movement Control Order (MCO).

Lifestyle items	All (%)	Male (%)	Female (%)
Exercise frequency			
5 - 7 times per week	6.2	35.7	2.0
3 – 4 times per week	9.7	14.3	9.1
1 – 2 times per week	68.2	42.9	71.7
None	15.9	7.1	17.20
Smoking	0.9	0.9	0
Eat while watching television	77.90	78.60	77.80
Calorie intake in comparison with body requirement			
Average Calculated daily calorie intake	1057.60 (SD=271.22)	1190.93 (SD=209.53)	1038.75 (SD=274.50)
More	3.50	0.00	4.00
Equal	0.90	0.00	1.00
Less	95.60	100.00	94.90
Added sugar intake in comparison with recommended nutrient Intakes			
Calculated daily added sugar intake / g	36.87	42.10	31.23

Table 3: Lifestyle data for participants post COVID-19 pandemic Movement Control Order (MCO).

Lifestyle items	All (%)	Male (%)	Female (%)
Exercise frequency			
5 - 7 times per week	0	0	0
3 – 4 times per week	18.6	35.0	15.1
1 – 2 times per week	68.1	55.0	71.0
None	13.3	10.0	14.0
Smoking	0.9	0.9	0
Eat while watching television	68.1	60.0	69.9
Calorie intake in comparison with body requirement			
Calculated daily calorie intake	1279.93	1256.75	1303.11
More	25.7	15	28
Equal	0	0	0
Less	74.3	85	72
Added sugar intake in comparison with recommended intake			
Calculated daily added sugar intake / g	41.47	43.23	39.84

and beverages. Recent studies suggest the intake of added sugar among Malaysian adults and children cannot be accurately determined; however, it appears to exceed the 10% of total calories limit recommended by the WHO,[24] a possible contributing factor to the rising obesity levels in the country.[25] Considering most Malaysians consume calories below the recommended RNI, these calories must not be 'empty' calories associated with sugar. Although a small snapshot of the larger picture, participants' calorie intake has increased pre to post-pandemic. Though this may seem a move in the positive direction, considering participants are consuming well below their recommended daily calories, this increase could be attributed to an increase in sugar intake, particularly in the case of female participants. A closer look at the food diary will provide a better indication.

Diet

Examining participants' food diaries from within the study, both pre and post-pandemic, the food choices are relatively simple and tend to lack variety. This is possible because most students live on campus and access the same eateries and convenience stores located both on campus and a 5km driving distance away. University regulations do not permit students to prepare meals within dorm rooms, and no kitchen facilities are offered. In addition, Malaysian culture is very convenience food and 'eating-out' oriented, and many prefer to purchase meals or ready meals rather than prepare them at home.

Most participants (91.2% pre-pandemic and 87.8% post-pandemic) ate one full meal daily (Table 4). In this case,

Table 4: Typical breakfast and lunch choices of participants both pre and post-COVID-19 pandemic Movement Control Order (MCO).

Breakfast Choices (In order)	Lunch Choices (in order)
1. Water and sliced white or wholemeal bread (with or without spread: Jam/ Majaraine/Chocolate/peanut butter) (>95%)	1. White rice with fried chicken with skin (either KFC style or fried and then added to a sauce)
2. Nestum cereal drink	2. Tomato rice with fried chicken
3. Koko Krunch or Honey Stars cereal with milk	3. White rice with whole fried fish and cooked vegetables
4. White rice with a fried egg	4. White rice with chicken hotdogs and vegetables
5. Fried Rice with boiled eggs	
6. Local branded Twiggies or muffins (cake)	
7. Dates and water	
8. Coffee bun	

lunch usually consisted of a large portion of white rice with fried chicken or fish. The fried chicken is either 'Kentucky' style or fried and then added to a sauce to produce a 'curry-like dish, similar to fish curry. Very few participants consumed fresh fruit or vegetables, except in the form of sweetened 'juice' drinks or stewed leafy green vegetables accompanying lunch. Snacks (Table 5) were either between meals in the conventional sense or, more commonly, used to substitute a full meal and consisted of biscuits, potato chips, sliced white bread, tea, coffee, hot chocolate, and Milo.

For most participants, breakfast (Table 4) seemed to be an afterthought. Trends before and after the pandemic were very similar. Only 19.8% ate breakfast pre-pandemic, which increased slightly to 29.1% post-pandemic. Those that did opt for slices of white bread, with or without a spread, washed down with a glass of water. A few students eat a breakfast of rice with egg, either boiled or fried, while others choose processed and sugar-laden cereal with milk, sugar-sweetened drinks, or cake. Considering most classes begin at 8 am, time constraints may limit the ability of students to eat a good breakfast, and it is assumed these items are pre-purchased. Thus, convenience seemed to be a common theme with the breakfast choices, as the options were either processed foods or food purchased the previous day and kept for breakfast. The limited choices are a direct reflection of the limited cooking facilities available to students and possibly also due to the lack of local grocery or convenience stores since most students live on campus in university accommodations. When directly questioned about finding food on campus, only 4.7% of all participants stated it was easy to find breakfast on campus. 97.7% and 32.6% of all participants also stated it was easy to find food for lunch and dinner, respectively. This indicates that the lower rates of breakfast (post 29.1%) and dinner (post 59.3%) eaters may be due to the difficulty in directly purchasing food. Current research suggests that missing breakfast leads to an increased incidence of coronary heart disease, and among the participants missing breakfast seems to be the norm. For participants, it appears breakfast choices are generally sugar-laden, processed, and very unlikely to satisfy hunger for any extended time. Breakfast eaters tended to opt for convenience and choose a meal consisting primarily of simple carbohydrates in the form of white sliced bread, sugar-riddled cereals, cereal-based 'breakfast' drinks, or cake. On a positive note, some participants consumed a more extensive breakfast consisting of fried rice or white rice with a boiled or fried (sunny side) egg.

Lunch for a great majority of participants (Tale 4), both pre and post-pandemic, seemed to be a focal point of the day and was regular and relatively substantial. Students are allowed a mid-day break for prayers and, of course, lunch. Participants listed similar descriptions of lunch, which directly reflects cafeteria food choices and the dietary staple of rice. Any differences were limited to the choice of beverage. The limited numbers of eateries on campus serve very similar varieties of food, catering to the Malay diet. White rice is the stable of choice. However, other rice varieties, including tomato and coconut rice, are also available. These are usually accompanied by a fried protein, either chicken or fish, and sometimes with cooked or stewed vegetables and tofu. Overall it appears that lunch is the most important meal of the day, where participants acquire most of their calories and nutrition. This has not changed post-pandemic. In terms of portion size, the descriptions provided by the majority of students eating lunch indicated a meal that is carbohydrate-heavy, where the portion of rice indicated by participants is two to three 'fist sized' portions, together with a fried protein and possibly vegetables. The lack of variety is an unfortunate aspect of living on campus.

The majority of participants ate during dinner (Table 6) time, and this remained relatively consistent pre (57.4%) and post-pandemic (59.3%), though the numbers are lower than lunch figures. The figures also mean that almost 40% did not eat dinner. Looking at the standard list of foods eaten at dinner, there is considerable variation compared to lunch. They ranged from full meals consisting of white rice and fried chicken to white sliced bread with a spread. However, the amount of dinner eaten varied considerably, which is crucial. While eating a small dinner in itself is not necessarily bad, many of the food choices made by participants were far from ideal and often consisted of convenience or processed foods. Fruits and vegetables are almost absent. Some participants had dinner very similar to lunch, white rice with fried chicken or fish. However, the top three dinner choices were sliced bread, instant noodles, and plain fried noodles (minimal protein). Interestingly, when asked about the motivations behind their food-buying decisions from canteens (post-pandemic), 64% and 28% of students gave affordability

Table 5: Typical snack and beverage choices of participants both pre and post-COVID-19 pandemic Movement Control Order (MCO).

Snack Choices (In Order of Magnitude)	Drink Choices (In Order of Magnitude)
1. Potato Crisps	1. Water
2. Biscuits	2. Juice drinks (sweet)
3. Cake	3. Milo (sweet)
4. Instant Noodles	4. Soya milk (sweet)
5. Fried noodles	5. Black tea without milk (sweet)
6. White sliced bread with a spread	6. Nestle Nestum Cereal Drink (sweet)
7. Chocolate	7. Coffee (3 in 1) (sweet)
8. Peanuts	8. Unsweetened green tea
9. Dates	9. Hot Chocolate (sweet)
10. Burger	10. Longan drink (sweet)
	11. Frappuccino (sweet)

Table 6: Typical dinner choices of participants both pre and post-COVID-19 pandemic Movement Control Order (MCO).

Dinner Choices (In Order)	
1. Water and sliced white bread (with or without spread)	9. Crisps, chocolates, nuts, or cake with water.
2. Instant noodles	10. Naan bread with cheese
3. Plain fried noodles	11. Dates and water
4. Fried Rice	12. Chicken Rice
5. Chicken rice porridge	13. Mushroom soup (canned) with sliced bread
6. White rice with fried chicken, fried fish, fried hotdogs, or tom yam chicken.	14. Chicken Biryani
7. Nasi Lemak with fried chicken	15. Burger King
8. Plain water	

and satisfying hunger, respectively, as the main reasons, and the remaining 8% cited health reasons for the choice. These figures were very similar pre and post-pandemic, with no significant difference.

Attitude

The respondent's attitudes towards diet and lifestyle show that Malaysian pharmacy students in the study are relatively realistic about their current health status, and the figures appear consistent pre (Table 7) and post-pandemic (Table 8). There is no significant difference between the attitude of male and female respondents towards dietary intake and lifestyle, and both sexes also scored well. Most students seem to hold no illusion regarding the state of their health, and in fact, only 40.7% (pre) and 43.4% (post) consider themselves with a healthy BMI, much lower than the actual figures of almost 54.9 % (pre) and 63.7% (post). Less than 26.6% (pre) and 20.9% (post) believe that they have a healthy diet, and over 93.7% (pre) and 90.3% (post) are attempting to eat more healthily. Concerning exercise, peer pressure holds a significant motivational influence on individuals when undertaking regular physical activity [26], and half of the respondents in the survey feel the same, where friends hold more significant influence compared with family. These numbers however reduce after the pandemic, from 59.3% before COVID-19 to 41.6% after.

Knowledge

Respondents generally have good diabetes knowledge scores, consistent for both pre (Table 9) and post-pandemic (Table 10), with very similar mean knowledge scores of over 80%. This is expected as Malaysian 3rd-year pharmacy students are exposed to intensive clinical training during the final two years. There is, however, some variability in answers to some questions. Half of the respondents were unsure of the term pre-diabetes. Though this is not unexpected, considering only the American Diabetes Association uses the term in a clinical context, defined as a blood glucose measurement of HbA_{1c} 5.7%. It may reflect, however, the nature of pharmacy education concerning diabetes, which focuses on management within a clinical setting more so than prevention in a community setting. Although overall diabetes knowledge is good, there is no relationship among the respondents between diabetes knowledge, attitude, and lifestyle. Generally, it has been shown that individuals with more excellent diabetes knowledge tend to be more physically active and with a carefully considered diet.[26]

DISCUSSION

The numerous risk factors that may lead to pre-diabetes or diabetes include an unhealthy diet, a sedentary lifestyle, obesity, and smoking. Diet can become a potentially severe risk factor for diabetes, even one that seems relatively innocuous, as demonstrated by the ever-increasing consumption of rice and sugar by Malaysians,[23] which can increase the risk of diabetes if consumed in large quantities.[27] These figures are interesting considering the results of the Malaysian Adult Nutrition Survey (MANS) survey in 2014 that almost 65% of 3000 Malaysians surveyed ate less than the recommended daily calories, similar to the 74% of post-pandemic participants in the current study that eat below the Malaysian RNI. Though there have been no direct studies conducted on the difference in the prevalence of diabetes among Malaysian various social classes in terms of income; B40 (bottom 40%), M40 (middle 40%), and T20 (top 20%), a recent PeKa B40 2019-20 report,[28] revealed 33% of those within the B40 group to suffer from at least one non-communicable disease, including diabetes. If we assume these figures are similar across all income groups, then the risk factors mentioned above become

Table 7: Attitude data for participant's pre-COVID-19 pandemic Movement Control Order (MCO).

Attitude items	All (%)	Male (%)	Female (%)
My BMI is normal	40.71	35.71	41.41
I have a healthy Diet	26.55	21.43	27.27
I am trying to eat healthily	93.70	92.30	93.90
I opt for a zero-sugar-sweetened beverage	50.15	51.0	49.3
I have a healthy lifestyle	27.43	50.00	24.24
My friends influence me to exercise	59.30	57.14	59.60
Smoking is unhealthy	99.00	100.00	99.01
Attitude mean score	70.43	70.55	70.41

Table 8: Attitude data for participants post COVID-19 pandemic Movement Control Order (MCO).

Attitude items	All (%)	Male (%)	Female (%)
My BMI is normal	43.4	30.0	46.2
I am trying to eat healthily	90.3	95.0	89.2
I have a healthy Diet	20.85	18.43	23.27
I opt for a zero-sugar-sweetened beverage	47.8	50.0	47.3
I have a healthy lifestyle	23.0	40.0	19.4
My friends influence me to exercise	41.6	45.0	40.9
I think smoking is unhealthy	96.5	90.0	97.8
Attitude mean score	65.2	65.6	65.1

Table 9: Knowledge data for participant's pre-COVID-19 pandemic Movement Control Order (MCO).

Questions	All (%)	Male (%)	Female (%)
Definition of Diabetes			
Right answer	87.60	92.90	86.90
Not sure	0.90	0.00	0.01
Definition of Pre-diabetes			
Right answer	49.60	28.60	52.50
Not sure	46.90	71.40	43.40
Is diabetes preventable?			
Right answer	92.00	85.70	92.90
Not sure	2.70	7.10	2.00
Risk factors: Pre-diabetes			
Right answer	98.20	85.70	100.00
Not sure	0.00	0.00	0.00
Risk factors: Diet			
Right answer	96.50	78.60	99.00
Not sure	0.00	7.10	1.00
Knowledge mean score	78.14	74.12	86.08

even more critical when the poorest of Malaysian society is not immune to diabetes prevalence, considering they are more susceptible to food insecurities. In addition, and more crucially, total calories may not be as important as the primary form of

Table 10: Knowledge data for participants post COVID-19 pandemic Movement Control Order (MCO).

Questions	All (%)	Male (%)	Female (%)
Definition of Diabetes			
Right answer	24.8	35.0	22.6
Not sure	14.2	10.0	15.1
Definition of Pre-diabetes			
Right answer	69.9	65.0	71.0
Not sure	25.7	35.0	23.7
Is diabetes preventable?			
Right answer	92.0	85.0	93.5
Not sure	2.7	0.0	2.7
Risk factors: Pre-diabetes			
Right answer	99.1	100	98.9
Not sure	0.9	0.00	1.1
Risk factors: Diet			
Right answer	100	100	100
Not sure	0.00	0.00	0.00
Knowledge mean score	77.16	77.0	77.20

Table 11: Pharmacist's Role data for participants both pre and post-COVID-19 pandemic Movement Control Order (MCO).

Questions	Pre	Post
Pharmacists can play a role in reducing the prevalence of diabetes by screening for blood glucose levels.		
Right Answer	92.00	92.9
Not sure	7.10	4.4
Pharmacists can play a role in reducing the prevalence of diabetes by acting as education providers.		
Right Answer	100	99.1
Not sure	0	0.9
Pharmacists can play a role in reducing the prevalence of diabetes by making the diagnosis of diabetes.		
Right Answer	31.00	38.9
Not sure	9.70	15
Overall mean score	86.44	80.24

those calories. As previously mentioned, sugar is the second most frequently consumed food item consumed by Malaysians,[23] and this may be a significant contributing factor to the incidence of obesity and diabetes, compared with total calorie intake.

What is interesting is to compare the top food choices before and after the pandemic. Though the overall choices made by students are almost identical, there has been a slight shift in eating habits, with slightly more students eating a rice-based dinner. The increase in numbers, however, is not significant pre and post-pandemic. Two other specific observations are that there is some overlap between dinner and snack options, where some students eat a dinner that other students may be eating as a snack. This indicates that many students are still eating small meals and are not meeting their required daily calorie intake. On a positive note, in the context of increasing calorie intake, participants do appear to be snacking much more frequently compared to the situation pre-pandemic. 66.8% of students listed 2 to 3 snack options within their food diary. Post-pandemic, this number goes up to a significant 93.6%. Unfortunately, most of the snack options are processed and sugar-laden. When asked directly about their preferred beverage with meals, 90% of participants said they preferred to drink water with meals. The food diaries, however, revealed a slightly different story, where most drink choices made by participants to accompany lunch and dinner were sugar-sweetened.

Physical inactivity and a sedentary lifestyle, as demonstrated by some respondents and also common among Malaysians,[29] will significantly contribute to health issues in later life. Obesity is a potentially common risk factor among students, and a similar prevalence figure was reported by the Malaysian National Health and Morbidity Survey, where 20.7% of adults are overweight, and 5.8% are obese, leading to fatty liver and insulin resistance. Though no students in the study were smokers, significant smoking numbers have been demonstrated among the general student population in Malaysia. Overall, smoker levels among male students were 31.6%.[30] The majority of respondents considered smoking unhealthy, similar to studies conducted among individuals with a higher level of education,[31] though it would be interesting to find out why a small minority of students answered this question as positive. Concerning knowledge, participants seem straightforward on the roles and responsibilities of pharmacists (Table 11) in diabetes prevention and management; the respondent seems to be aware of the role of pharmacists and the provision of screening and medicines management services. However, a small but significant number, 31.00% (pre) and 38.9% (post) seem to believe pharmacists can provide a clinical diagnosis for diabetes. This critical issue must be clarified to ensure that pharmacy students and new graduates fully understand their roles in tertiary healthcare.

CONCLUSION

The current study attempted to look at trends in diet and lifestyle in two groups of third-year undergraduate Malaysian pharmacy students, pre and post COVID-19 pandemic, to identify any lasting effects of the movement control orders. Most Malaysian pharmacy students participating in this study did not consume sufficient calories. Before the COVID-19 pandemic and the introduction of movement control orders, only 5% of participants were consuming sufficient calories to meet the Malaysian recommended nutrient intake (RNI). Post-pandemic, though this number increased to 26%, most still fell short. Though this is a positive move, ultimate food choices are essential, and it appears the form of those additional calories is slowly shifting towards more processed and empty calories, as indicated by a slight increase in the average daily sugar intake among participants from 36.9 g to 41.5 g. More students were snacking, going from pre to post-pandemic. Unfortunately, the snacks themselves were generally processed and sugar-laden. Lunch was a focus point for most, consisting in most cases of a large quantity of rice with a fried protein of fish or chicken. Overall, however, participants' food diaries demonstrated a less-than-ideal diet, where apart from lunch, which consisted of a relatively balanced meal, the remainder of the food options were nutritionally inferior. On a positive note, participants remained physically active, and activity levels pre and post-pandemic appear to be generally the same, with a slight reduction in higher frequency activity predominantly among male participants.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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