Original Research Article

Exploring Sociodemographic Characteristics, Sleep Quality, Food Group Consumption, and Body Weight Status among University Students during the COVID-19 Movement Restriction

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ABSTRACT

The COVID-19 pandemic has profoundly affected lifestyles, including sleep quality, dietary habits, and body weight status. This cross-sectional study investigated the associations between sociodemographic characteristics, sleep quality, food group consumption with body weight status among university students during Malaysia's Movement Control Order (MCO). An online survey was conducted with 145 participants, aged 19-24 years old between June - Aug 2021. Data on socio-demographics, sleep quality, food group consumption, and self-reported anthropometric measures were collected. The findings showed 46.2% had normal weight, 37.2% were overweight or obese, and 16.6% were underweight. Majority being 22 years old (80%), female (91.7%), and of Malay ethnicity (93.1%). Sleep quality was reported as fairly good by 44.1% of respondents, and beverages were the most consumed food group (median: 5.42 servings/day). Age was positively correlated with body mass index (BMI) (r=0.179, p<0.05), while dietary intake of cereals and cereal products showed a significant positive association with BMI (r=0.435, p<0.05). Conversely, fish and seafood consumption was inversely associated with BMI (r=-0.185, p<0.05). No significant association was observed between sleep quality and BMI. In conclusion, age and specific dietary patterns, particularly the consumption of cereals and fish, were significant factors associated with body weight status during the MCO period. These findings highlight the need for targeted nutritional education and interventions to promote balanced dietary habits, especially during periods of restricted mobility, to mitigate potential adverse effects on body weight and overall health.

Keywords: COVID-19, sleep quality, dietary intake, body weight status, university students, nutritional status

INTRODUCTION

Obesity and overweight have emerged as significant global health concerns, particularly among young adults. The prevalence of these conditions has been steadily increasing, leading to a rise in associated health risks such as cardiovascular disease, type 2 diabetes, and certain types of cancer.[1, 2] University students, are particularly vulnerable to unhealthy lifestyle behaviours, including poor sleep quality and suboptimal dietary

patterns, which can contribute to weight gain and obesity.

National Health Morbidity Survey (NHMS) [3] reported that more than 50% of Malaysian adults were overweight or obese and more than half of them have abdominal obesity. The prevalence of overweight and obesity among Malaysian university students is 21.2% and 16.3%.[4] This prevalence of overweight and obesity in Malaysia has shown quite a big number that is very concerning. Understanding how these factors interact to influence body weight status during such unprecedented times is critical for developing effective health interventions.

This issue has been further exacerbated by the COVID-19 pandemic and the related lockdowns, or Movement Control Orders (MCO). The WHO announced the global 2019 novel coronavirus (COVID-19) disease outbreak as public health emergency of international concern on January 30, 2020. As concerning the pandemic outbreak in Malaysia, Malaysian government announced the movement control order (MCO) starting 18th March 2020. Malaysia implemented a nationwide total lockdown or Full Movement Control Order (FMCO) from 1st June to 1st October 2021. This lockdown had a significant impact on university students, as they transitioned to online distance learning during this period. The implementation of the MCO to curb the spread of the virus further accentuated these lifestyle changes, particularly among university students who faced unique challenges related to remote learning, social isolation, and restricted mobility.

The pandemic significantly disrupted lifestyle behaviors, with many individuals experiencing changes in sleep patterns, decreased physical activity, and shifts in dietary habits, including increased consumption of processed and calorie-dense foods.[5, 6] These behavioral changes, coupled with heightened stress and reduced access to structured physical activities during the lockdowns, have contributed to an elevated risk of weight gain and obesity

in this demographic.[5] The sudden shift to remote learning and work-from-home arrangements disrupted daily routines, leading to increased sedentary behavior, altered sleep patterns, and changes in dietary habits. These lifestyle changes have the potential to contribute to weight gain and obesity.[7]

A recent study highlighted the impact of lockdown on body weight status. Research conducted in Poland found that 34% of participants gained weight, while 18% experienced weight loss. Weight gain was associated with negative lifestyle changes, including increased screen time and reduced physical activity. Conversely, weight loss was linked to positive lifestyle changes, such as higher vegetable intake, reduced consumption of confectionery, fast food, and sugary beverages, increased sleep duration, and more frequent physical activity.[8]

A study in Chile found that 25.6% of men and 38.1% of women gained weight during the COVID-19 lockdown, with weight gain associated with low water intake, reduced physical activity, and over six hours of sedentary behavior daily.[9] Similarly, research in the United States reported that 22% of participants gained weight, while 15% lost weight during self-quarantine. Weight gain was linked to poor sleep, post-dinner snacking, reduced physical activity, stress, and eating without hunger. These findings demonstrate that body weight changes during lockdowns are closely tied to individual behaviors at home.[10]

Research indicates that the COVID-19 lockdown adversely impacted sleep quality and lifestyle behaviors among young adults, including university students. Studies on Spanish[11] nursing students and Italian [12] university students reported a decline in sleep quality during the lockdown compared to pre-pandemic levels. In China, youth experienced weight gain, increased screen time, reduced physical activity, and disrupted sleep patterns.[12] Similarly, 40.3% of Italians reported slight weight gain, with 8.3% noting significant weight gain during

the lockdown.[13] Among international medical students, 10% reduced their fruit and vegetable intake, while in Spain, food science students and professionals reported a marked increase in the consumption of homemade pastries (50%) and snacks such as chocolate and salty items (28% each).[14] Early studies during the COVID-19 lockdown focused on sleep quality and psychological impacts[15], but the relationship between body weight status, sleep quality, and food group consumption remains unclear. This study addresses the gap by examining the associations between sociodemographic factors, sleep quality, food group consumption, and body weight status among Malaysian university students during the MCO.

MATERIALS & METHODS

This cross-sectional study was conducted through an online survey targeting full-time university students enrolled in public or private institutions in Malaysia during the Movement Control Order (MCO) period from 1st June to 1st October 2021 when online distance learning was implemented across the country. The participants consisted of undergraduate university students who met the specified inclusion criteria. The inclusion criteria for this study were Malaysian university students aged 18 years and older, whereas the exclusion criteria comprised individuals who were pregnant or lactating.

Sampling method

This study employed a non-probability sampling method known as snowball sampling. Snowball sampling is a recruitment technique whereby study participants are solicited to assist researchers in identifying additional potential participants. This sampling method is particularly suitable for implementation during the Movement Control Order (MCO), as recruiting participants during this period poses significant challenges for researchers. The process necessitated an initial outreach through the researcher's acquaintances, followed by the dissemination of the questionnaire by the participants themselves, thereby facilitating the recruitment process under conditions of restricted movement. The participant recruitment process was concluded once the desired sample size was achieved.

Study Instrument

A self-administered questionnaire in English served as the instrument for this study. The questionnaire was organised into four sections. The first section, Part A, focused on sociodemographic factors; Part B addressed anthropometric measurements; Part C comprised questions regarding sleep quality; and the final section, Part D, included questions pertaining to food group consumption.

Socio-demographics characteristics

The sociodemographic factors were assessed using a questionnaire that contained 12 questions related to age, sex, ethnicity, religion, state, university, type of university, education level, study programme, living arrangement, current year of study, and monthly pocket money.

Anthropometry assessment

The anthropometric assessment data were obtained through self-reported information via a questionnaire, which required participants to provide their current weight, and their height. The Body Mass Index (BMI) of the participants was calculated based on their self-reported weight and height using the formula: weight (kg) divided by height (m) squared. The BMI classification employed in this study is the Asian cut-off established by the WHO. [16]The BMI categories are as follows: underweight (BMI less than 18.5 kg/m²), normal weight (BMI 18.5 kg/m² – 22.9 kg/m²), overweight (BMI 23.0 kg/m² – 24.9 kg/m²), and obese (BMI more than 25.0 kg/m²).

Sleep quality

The instrument employed to assess sleep quality is the Pittsburgh Sleep Quality Index (PSQI) questionnaire. [17] Participants were instructed to respond to the questionnaire based on their typical sleep habits over the preceding month. This questionnaire comprises 18 individual items. Items 1-4 consist of open-ended questions pertaining to participants' sleep patterns during the past month, while items 5-9 utilise a four-point Likert-style rating scale to evaluate the frequency of sleep difficulties experienced by the subjects. The scoring system ranges from 0 to 3 points, wherein 0 indicates 'not during the past month', 1 signifies 'less than once a week', 2 denotes 'once or twice a week', and 3 represents 'three or more times a week'. The scores generated from these items yield seven component scores, which include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The aggregate of these seven component scores produces a single global score, with a score of 5 or higher indicating poor sleep quality. The PSQI demonstrates internal consistency and a reliability coefficient (Cronbach's alpha) of 0.82 for its seven components. [17]

Food group consumption
The instrument utilised to ascertain the food group consumption of the participants was the Food Frequency Questionnaire (FFQ). The FFQ employed in this study was adapted from the Malaysian Adults Nutrition Survey (MANS) 2014.[18] It encompassed 14 categories of food and a total of 165 varieties of foods within this section. Cereals and cereal products comprised 18 varieties; fast food included eight varieties; meat and meat products consisted of 11 varieties; fish and seafood encompassed 15 varieties; eggs included four varieties; legumes and legume products comprised five varieties; and milk and milk products contained six varieties. Additionally, vegetables included 14 varieties; fruits comprised 26 varieties; drinks encompassed 16 varieties; alcoholic drinks contained six varieties; confectionery included 12 varieties; bread spreads comprised 8 varieties; and flavourings encompassed 16 varieties. The food group consumption of the participants was identified by observing the frequency with which each food group was consumed. The anticipated food group consumption was based on the newly developed food pyramid by the Ministry of Health, Malaysia which recommended three or more servings of vegetables, two servings of fruits, three to five servings of cereals and cereal products, one serving of fish, one to two servings of meat, chicken, and eggs, one serving of legumes, and two servings of milk and milk products.[19]

Data collection procedure
All questionnaires utilised in this study adhered to a self-report format. Data were collected online via Google Forms, with the questionnaire link disseminated through social media networks employing a snowball sampling method. Participants responded to the questions, after which the link was shared with additional university students to promote further participation. The distribution of the link occurred in several phases until the target number of respondents was attained.

STATISTICAL ANALYSIS
Statistical analysis was conducted using IBM SPSS Statistics 25 (IBM Corp., Armonk, NY). Categorical variables were reported as frequencies and percentages, while continuous variables were presented as means and standard deviations. A significance level of $p < 0.05$ was established to evaluate the hypothesis. The Pearson Correlation test was employed to assess the correlation between two normally distributed continuous variables, whereas the Spearman Correlation test was utilised for continuous variables that did not conform to a normal distribution.

RESULT

A total of 145 participants completed the online survey. Table 1 outlines their sociodemographic profiles. The mean age was 21.83 ± 0.79 years, with the majority being 22 years old (80%) and of Malay ethnicity (93.1%). Most participants originated from the east coast region (40.7%) and were female (91.7%), potentially reflecting lower participation rates among male students in voluntary online surveys. As the survey was conducted during the MCO, 69.0% of participants were residing at home, continuing their studies online. Additionally, 95.2% of participants were enrolled in public universities, with 64.8% pursuing bachelor's degree programmes and 61.4% in their third year. The majority reported a monthly budget of MYR 100.01 to 500.00 (35.2%).

Table 1 Sociodemographic profiles of the participants

Socio-demographic characteristics	n (%)	Mean ± SD
Age		21.83 ± 0.785
Sex:		
Male	12 (8.3)	
Female	133 (91.7)	
Ethnicity:		
Malay	135 (93.1)	
Non-Malay	10 (6.9)	
Regions:		
Northern region	17 (11.7)	
East coast region	59 (40.7)	
Central region	37 (25.5)	
Southern region	27 (18.6)	
Sabah & Sarawak	5 (3.4)	
Living Arrangement:		
College Dormitory	41 (28.3)	
Own House	104 (71.7)	
Type of higher education:		
Public	138 (95.2)	
Private	7 (4.8)	
Year of study:		
Year 1	9 (6.2)	
Year 2	40 (27.6)	
Year 3-5	96 (66.2)	
Monthly pocket money:		
≤ MYR 100.00	38 (26.2)	
MYR 100.01 – 300.00	51 (35.2)	
MYR 300.01 – 500.00	39 (26.9)	
MYR 500.01	17 (11.7)	

Body weight status of the participants

Table 2 presents the body weight status and anthropometric measurements of the participants. The mean weight was 57.23 ± 13.04 kg, while the mean height was 159.06 ± 5.93 cm. The calculated mean Body Mass Index (BMI) was 22.58 ± 4.81 kgm^{-2}, indicating an overall normal weight range for the group. The distribution of body weight status revealed that 16.6% of participants were categorized as underweight (n = 24), 46.2% as having a normal weight (n = 67), and 37.2% as being overweight or obese (n = 54).

Table 2 Body weight status of the participants

Body weight status	(n)	%	Mean ± SD
Weight (kg)	-	-	57.23 ± 13.04
Height (cm)	-	-	159.06 ± 5.93
Body Mass Index (BMI) kg^{-m2}			22.58 ± 4.81

Body weight status:		
• Underweight	24	16.6
• Normal	67	46.2
• Overweight & Obese	54	37.2

Sleep quality and its components among the participants

The findings presented in Table 3 elucidate several significant aspects of sleep quality among the participants. Subjective sleep quality was predominantly rated as "fairly good" by 44.1% of respondents; however, a considerable proportion (45.5%) reported experiencing "fairly bad" or "very bad" sleep, indicating a widespread dissatisfaction with sleep among the participants. The results concerning sleep latency revealed that 51.1% of individuals required 30 minutes or more to fall asleep, with 16.6% needing over an hour, thereby reflecting substantial difficulty in initiating sleep. Sleep duration is particularly concerning, as 35.2% of participants reported sleeping for less than 5 hours per night, and only 21.4% achieved the recommended minimum of more than 7 hours, suggesting a prevalent state of sleep deprivation.

Despite these challenges, 71.0% of participants exhibited good sleep efficiency (>85%), although 17.2% demonstrated very low efficiency (<65%), likely indicating fragmented or interrupted sleep. Sleep disturbances were reported as occurring less than once per week by 64.1% of participants; however, 30.3% experienced disturbances 1–2 times per week or more, signalling frequent disruptions within a notable subgroup. While the utilisation of sleep medication was low, with 89.7% reporting no use, daytime dysfunction was prevalent, as over half (52.4%) of participants experienced issues such as fatigue or impaired focus at least once or twice per week

The mean global Pittsburgh Sleep Quality Index (PSQI) score was 8.14 ± 3.44, with 84.8% of participants classified as having poor sleep quality. These results underscore significant sleep-related issues among the participants, particularly regarding sleep duration, latency, and daytime dysfunction. The high prevalence of poor sleep quality underscores the necessity for targeted interventions to address these challenges and promote improved sleep health among university students.

Table 3 Sleep quality and its component among the participants (n=145)

Sleep Quality	n (%)	Mean ± SD
Subjective sleep quality:		
Very good	15 (10.3)	
Fairly good	64 (44.1)	
Fairly bad	46 (31.7)	
Very bad	20 (13.8)	
Sleep latency:		
≤15 min	43 (29.7)	
16-30 min	28 (19.3)	
31-60 min	50 (34.5)	
>60 min	24 (16.6)	
Sleep duration:		
≥7 hours	31 (21.4)	
6 hours	32 (22.1)	
5 hours	32 (21.4)	
<5 hours	51 (35.2)	
Sleep efficiency:		
>85%	103 (71.0)	
75-84%	10 (6.9)	
65-74%	7 (4.8)	
<65%	25 (17.2)	

Sleep disturbance:		
Not during the past few months	11 (7.6)	
<1/week	93 (6.1)	
times/week	37 (25.5)	
≥3 times/week	4 (2.8)	
Use of sleep medication:		
Not during the past few months	130 (89.7)	
<1/week	10 (6.9)	
1-2 times/week	3 (2.1)	
≥3 times/week	2 (1.4)	
Daytime dysfunction:		
Not during the past few months	21 (14.5)	
<1/week	48 (33.1)	
1-2 times/week	61 (42.1)	
≥3 times/week	15 (10.3)	
Global PSQI score:		8.14 ± 3.44
Good sleep quality	22 (15.2)	
Poor sleep quality	123 (84.8)	
PSQI: Pittsburgh Sleep Quality Index		

Food Group Consumptions of the participants

Table 4 presents the correlations between age, components of sleep quality, consumption of food groups, and body weight status among the participants. The analysis indicates a significant positive correlation between age and body weight status ($r = 0.179$, $p = 0.032$), suggesting that older participants exhibited higher body weight status.

With respect to sleep quality, none of the components demonstrated statistically significant correlations with body weight status. For instance, subjective sleep quality ($r = 0.058$, $p = 0.489$), sleep latency ($r = 0.084$, $p = 0.318$), and global PSQI score ($r = 0.030$, $p = 0.717$) displayed weak and non-significant relationships. Although sleep efficiency and daytime dysfunction revealed slight negative correlations ($r = -0.051$, $p = 0.544$ and $r = -0.070$, $p = 0.404$, respectively), these associations were not statistically significant.

In contrast, food group consumption yielded notable findings. A strong and significant positive correlation was observed between the consumption of cereals and cereal products and body weight status ($r = 0.435$, $p < 0.001$), indicating that a higher intake of this food group was associated with increased body weight status. Conversely, fish and seafood consumption exhibited a significant negative correlation with body weight status ($r = -0.185$, $p = 0.026$), suggesting that greater intake of fish and seafood was linked to lower body weight status. Additionally, confectionery consumption demonstrated a marginally significant positive correlation ($r = 0.156$, $p = 0.060$), implying a potential association with increased body weight status. Other food groups, such as vegetables, fruits, dairy products, and fast food, exhibited weak and non-significant correlations.

In summary, age and specific dietary factors, particularly increased cereal consumption and decreased fish and seafood intake, were significantly associated with body weight status. The components of sleep quality did not show significant correlations with body weight status in this study. These findings suggest that dietary habits may exert a more substantial influence than sleep quality on body weight status among Malaysian university students during the Movement Control Order.

Table 4 Correlations between age, sleep quality and food group consumption with body weight status

Variables	Mean ± SD / Median	r / r_s	*p*-value
Age	21.83 ± 0.79	0.179	0.032
[†]**Sleep quality:**			

Subjective sleep quality	1.49 ± 0.86	0.058	0.489
Sleep latency	1.38 ± 1.08	0.084	0.318
Sleep duration	1.70 ± 1.16	0.888	0.291
Sleep efficiency	0.68 ± 1.17	- 0.051	0.544
Sleep disturbance	1.23 ± 0.62	0.076	0.366
Use of sleep medication	0.15 ± 0.51	- 0.114	0.172
Daytime dysfunction	1.48 ± 0.87	- 0.070	0.404
Global PSQI Score	8.14 ± 3.44	0.03	0.717
‡**Food Group Consumption:**			
Cereals and cereals product	3.43	0.435	0.000
Fast Food	0.35	0.046	0.585
Meat and meat product	1.03	0.050	0.547
Fish and seafoods	0.56	- 0.185	0.026
Eggs	0.14	0.033	0.691
Legumes and legumes product	0.09	0.081	0.332
Milk and milk products	0.31	0.071	0.398
Vegetables	1.68	- 0.072	0.387
Fruits	0.57	0.044	0.596
Drinks	5.42	- 0.048	0.570
Confectionaries	0.58	0.156	0.060
Bread spread	0.15	0.025	0.762
Flavours	1.18	0.011	0.893
[†]Pearson Correlation, Values are mean ± standard deviation (SD), ‡Spearman Correlation, Values are median			

DISCUSSION

The present study reveals that while most Malaysian university students had a normal body weight status, approximately one-third of participants were classified as overweight or obese (37.2%). This result aligns with findings from Gan and Yeoh[20], who reported that most undergraduate university students were within the normal weight category. However, the relatively high proportion of students with overweight or obesity in this study underscores the importance of addressing weight-related issues in this population. Notably, the prevalence of overweight and obesity observed here is lower than the national figure reported by the NHMS 2014, which indicated that one in two Malaysian adults were either overweight or obese.[18] This discrepancy could be attributed to differences in the sample population, age group, or the impact of the MCO on lifestyle behaviors.

The findings indicate that although a significant proportion of participants reported poor sleep quality, no significant correlation was observed between sleep quality components and body weight status.

This result contrasts with previous studies conducted prior to the COVID-19 pandemic and MCO. For instance, Suhaimi et al.[21] identified an association between poor sleep quality and body weight status, while Santana et al.[22] similarly reported no significant relationship between sleep duration and weight status. The discrepancies may be due to the unique lifestyle changes imposed by the MCO, such as increased academic demands, back-to-back online classes, and disruptions to normal sleep patterns.

Consistent with the current findings, Vargas et al.[23] found no significant relationship between daytime dysfunction and BMI among Indian university students. In contrast, Kwan [24] reported a positive association between poor sleep quality and BMI among Malaysian university students, suggesting that lifestyle differences pre- and post-MCO may influence these outcomes. Suhaimi et al.[21] similarly found that more than half of overweight or obese students experienced poor sleep quality compared to their normal-weight counterparts.

The COVID-19 pandemic and associated lockdown measures appear to have

exacerbated sleep quality issues among university students. Previous studies have reported similar findings globally, where students experienced worsened sleep quality, later bedtimes, and increased sleep disturbances during lockdown periods.[11, 25] For example, Zhou et al.[26] reported a high prevalence of insomnia among Chinese high school and college students, attributing this to increased anxiety and depression. These mental health challenges were also highlighted in studies conducted in Italy, the USA, and China, which documented deteriorating sleep quality among students during the pandemic.[26, 27] The MCO may have similarly contributed to increased stress, disrupted routines, and reduced physical activity, all of which are known to negatively impact sleep quality. [26]

The current study identified a significant association between fish and seafood consumption and lower BMI values. This finding aligns with prior research, such as Kamaludin et al.[15], which reported that healthy dietary patterns, including regular seafood consumption, were associated with lower BMI. However, the participants in this study consumed fish and shellfish at amounts below the daily requirement, with an average intake of less than one serving per day. This could be attributed to the food group's accessibility and availability throughout the MCO period.

Studies conducted among Portuguese university students revealed similar trends of poor dietary habits, characterised by low consumption of fruits, vegetables, and fish, alongside a high intake of fast food, sugary drinks, and processed foods. [28] Similarly, Reyes-Olavarría et al. [9] observed that while Chilean populations maintained positive dietary behaviours, such as daily consumption of vegetables and fruits, they also reported an increased consumption of junk food during the COVID-19 pandemic. Regular consumption of fast food, sugary drinks, and fried foods was significantly associated with overweight and obesity among university students, while inadequate intake of fruits and vegetables further exacerbated this trend. Comparable patterns were noted in a Brazilian study by da Mota Santana et al.[22], which linked adherence to processed and ultra-processed food consumption during social distancing to weight gain. These findings emphasise the critical role of dietary habits in influencing body weight status, particularly during periods of restricted movement and heightened stress.

The COVID-19 pandemic and MCO period significantly disrupted lifestyle behaviors, including sleep quality, dietary habits, and physical activity. Studies conducted in Poland, Italy, and China documented notable weight changes and sleep disturbances during lockdowns.[8, 26, 27] These disruptions were often exacerbated by increased stress, depression, and anxiety among students, contributing to maladaptive coping mechanisms such as poor dietary patterns and reduced physical activity.

LIMITATIONS
Several limitations of this study must be acknowledged. First, as a cross-sectional study, causal relationships between sleep quality, dietary habits, and body weight status cannot be established. Second, the reliance on self-reported weight and height may introduce recall bias or inaccuracies. Additionally, underreporting of food intake in the food frequency questionnaire (FFQ) may have occurred due to the extensive list of food items, leading to participant fatigue or hasty responses. Finally, the study did not assess lifestyle changes specifically during the MCO, limiting our understanding of how pandemic-related restrictions influenced long-term behaviours.

CONCLUSION
The findings from this study underscore the complex relationships between body weight status, sleep quality, and dietary habits among Malaysian university students during the MCO. While no significant associations were found between sleep quality and body weight, dietary factors, particularly fish and seafood consumption, were inversely

associated with BMI. The COVID-19 pandemic and associated disruptions likely contributed to poor sleep quality and altered dietary patterns, highlighting the need for targeted interventions to promote healthy lifestyles during similar unprecedented events. Future research should explore the longitudinal impacts of lifestyle changes during and after lockdown periods to better understand their implications for student health and well-being.

Authors' Contributions

Wan Afiqah Nadhrah MS, conceptualized and designed the study, led the data collection, data analysis and interpretation, Zuriati I, principle investigator, supervise the research, data analysis and interpretation, prepared the draft of the manuscript and reviewed the manuscript.

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