

Original Research Article

COVID-19 pandemic afflicts lifestyle and dietary habits of female university students

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ABSTRACT

Background: Coronavirus (COVID-19) pandemic has triggered a profound effect on all aspects of society, including mental and physical health in Saudi Arabia and over the globe. The pandemic has put a spotlight on the important role of nutrition in supporting the immune system relative to viral infections. The application of physical separation was the main scale used worldwide to fight COVID-19. Unavoidable nationwide cultural intercessions, such as lockdown, curfew and quarantine, imposed by the governments, resulted in unexpected outcomes such as financial difficulties, economic burden, changes in lifestyle and dietary habits, and the breakdown of psychosocial and metabolic well-being.

Methods: This cross-sectional study was conducted to evaluate the impact of COVID-19 pandemic on lifestyle and dietary habits among female university students in Saudi Arabia. Three hundred (300) participants aged 18-25 years were randomly recruited using convenient sampling. A structured self-administrated online questionnaire was used to collect the information on lifestyle, physical activity, health history and dietary habits. We hypothesized that the pandemic and its consequent restriction measures would adversely impact the lifestyle and dietary habits of students.

Results: There was a significant association between lockdown and weight gain ($p < 0.001$) with 65% of participants reporting 5-11 kg weight gain during the pandemic. Lifestyle change, availability of food at home and stress/anxiety due to COVID-19 were the most common factors reported for weight gain (47%, 29% and 19%, respectively). A significant association ($p < 0.001$) was found between screen time and COVID-19 lockdown with more than 10 hours spent in front of screens. Similarly, a significant change ($p < 0.001$) was reported in food consumption and dietary behaviour during COVID-19. Most participants consumed home-made food (94%) while only 4% consumed foods from outside and 2% consumed fast food from restaurants.

Conclusions: COVID-19 had a negative impact on lifestyle changes, dietary habits and physical activity, which was associated with significant weight gain among Saudi university students. This effect is attributed to the restriction measures that decreased the physical activity, and the psychological aspects that affected the quality and quantity of food consumed. Increasing awareness, healthy dietary plans and physical activity are highly recommended during the pandemic.

Keywords: COVID-19, Dietary habits, Female university students, Lifestyle, Physical activity, Saudi Arabia

INTRODUCTION

A new coronavirus (SARS-CoV-2) appeared in China in 2019, initiating an acute respiratory disorder pandemic (COVID-19).¹ The quick and exacting application of physical separation was the main scale used worldwide to fight COVID-19. Unavoidable nationwide cultural intercessions, such as lockdown, curfew and quarantine, imposed by the governments, resulted in unexpected outcomes such as financial difficulties, economic burden and the breakdown of psychosocial and metabolic well-being. The psychosocial impact resulted in acute panic, anxiety, obsessive behaviors, depression, and post-traumatic stress disorder.² This effect raised the risk of obesity combined with metabolic comorbidity in social institutions with obesogenic conditions.²

While strict prophylactic procedures are essential to safe public health, they might significantly change peoples' natural routine, involving lifestyle-associated conduct. Sitting and working at home can influence dietary intake, food frequencies and choices, access to food, and further reduce physical activity (PA). It was found that home confinement passively impacted PA levels, mostly for males, overweight people, and elderly.³ Daily sitting time increased from 5 to 8 hours a day through COVID-19 pandemic.⁴ Before COVID-19, PA, excessive screen time and obesity were characterized as a global public health problem. The current COVID-19 pandemic has aggravated this statue. The pandemic condition was further correlated with fear, depression and anxiety feelings that have been suggested to decrease the sleep quality. In addition, seated habits, anxiety, and weariness induced by home restriction could affect inspiration to eat, alter lifestyle patterns, decrease diet quality and advance overconsumption, in spite that the calorie admission should be limited.⁴

A few studies have investigated the impact of COVID-19 on eating habits and lifestyle. Di Renzo et al investigated eating habits and lifestyle changes during COVID-19 lockdown among 3533 Italians (76.1% females) aged 12 to 86 years.³ They found that 48.6% of participants gained weight. Matsungo and Chopera studied the impact of COVID-19 induced quarantine on nutrition, alcohol consumption, PA and smoking among 507 females aged ≥ 18 years.⁵ The quarantine period was related to decreased diet variety, high food prices, disrupted dietary patterns and elevated stress. There was perceived weight gain and low level of PA during the quarantine period, so the risk of overweight and obesity was increased. Ammar et al studied the effect of home confinement on different lifestyle behaviours among 1047 participants (54% women) during COVID-19 outbreak.⁶ Home confinement adversely influenced PA and increased daily sitting time from 5 to 8 hours. Dietary intake and meal distribution (type of food, number of meals, and frequency) were unhealthier during the quarantine. Another cross-sectional study was conducted by Alhusseini and Alqahtani to measure the impact of COVID-19 pandemic on eating

habits, quality and quantity of food intake among 2706 Saudi adults.⁷ More than eighty five percent (85.6%) of responders reported eating home-cooked meals daily during COVID-19 as compared to 35.6% before the pandemic. Similarly, Górnicka et al identified the types of dietary changes during COVID-19 and their relationship with sociodemographics, body mass index (BMI), and lifestyle changes among 2381 participants.⁸ Results showed that 43% of responders decreased PA, 49% increased screen time, and 34% increased food consumption. Almost 70% of participants reported no difficulties with food availability during the pandemic, and 64% of them ate more food. Di Renzo et al studied the correlation between eating habits, mental and emotional mood among 602 Italians aged 18-66 years.⁴ A high percent of participants experienced anxious feelings, depressed mood and insomnia. Half of participants increased their food consumption, and females were more anxious than males. In a retrospective study to assess the impact of COVID-19 curfew on eating habits, food intake, and weight in Saudi Arabia, Mumena reported that the changes in dietary patterns (mealtime and daily number of meals) during the curfew were more common among severely food-insecure participants.⁹ Food-secure participants had higher consumption of organic products, fruits, savoury snacks and candies.

Another study was done by Pellegrini et al to assess the changes in weight and dietary habits in 150 obese Italians after 30 days of enforced COVID-19 lockdown.¹⁰ The mean weight gain was 1.5 kg. Consumption of snacks, unhealthy foods, less exercise, and psychological distress were significantly related to higher weight gain. Differing results were obtained by Poelman et al who found that most participants did not change their food purchases (73.3%) or eating behaviours (83.0%), and those with higher BMI were more likely to eat unhealthier during lockdown compared to members with normal BMI.¹¹ In a recent study on 415 Kuwaiti adults (18-73 years), Husain and Ashkanani observed that neglecting breakfast remained steady before/during COVID-19.¹² Contrasted with before COVID-19, individuals were more probably having a late-night snack or meal. However, there was severe decline in consumption of fast-food, a significant decrease in actual movement, and an increase in screen time and sedentary behaviours. Ingram et al studied the alteration in health behaviours and their association with bad mind-set among 399 participants during COVID-19 lockdown.¹³ Poor sleep was correlated with a more negative mind-set and less protection from infection. Poor diet and less PA were related to more negative mood.

The objective of the present study was to evaluate the changes in lifestyle and dietary habits among Saudi female university students during COVID-19 pandemic, and to determine the major reasons for these changes. We hypothesized that COVID-19 pandemic and its subsequent measures would negatively influence the lifestyle and dietary habits of female university students.

METHODS

Study design

This cross-sectional study was conducted on female university students (18-25 years) randomly recruited from Imam Abdulrahman Bin Faisal University, located in the city of Dammam, the most populated metropolitan in the Eastern Region of Saudi Arabia. Participants were selected during the academic year 2020-2021 using convenience sampling. Participants were excluded from the study if they were pregnant or lactating, suffering from any mobility or health problems, or have any chronic disease (respiratory diseases, diabetes, cardiovascular disease, or immune-compromised people). According to the university active students' demographics, the number of female students during that academic year was 21,214 (72% of total enrolled undergraduate students). To achieve the study objectives and sufficient statistical power, sample size was calculated using sample size calculator, which was 378 participants, using a margin of error of 5%, a confidence level of 95%, and a 50% response distribution.¹⁴ A valid and reliable self-administered online questionnaire was used to collect the required information about health history, lifestyle, physical activity and dietary habits, where 300 students responded to the survey. The study hypothesized that the exceptional conditions induced by COVID-19 pandemic will be positively associated with increased body weight, decreased physical activity, and altered lifestyle and dietary habits.

Statistical analyses

Data analysis was performed using Microsoft Excel worksheet, IBM SPSS Statistics 26, and RStudio software. McNemar's Chi-square test was used to determine whether there is a change in the lifestyle and dietary habits among students due to the COVID-19 pandemic. The results were presented and explained using descriptive statistics, frequencies, and percentages, graphs such as bar-plot, pie chart, histograms, Chi-square test for association and Student t test for comparison. P value of ≤ 0.05 was considered statistically significant. Considerations have been taken to eliminate any potential source of bias during study design, data collection, and analysis. This has been done through choosing the proper study design for the intended objective, setting inclusion and exclusion criteria, calculating the adequate sample size, running a pilot exploratory circulation of the survey to confirm its validity, and applying the proper statistical analysis of the obtained data.

Ethical considerations

Participants were given all the information about the objectives and procedures of the study. Discriminating, degrading, and hard language were assured to be avoided in the questionnaire and during any contact with participants. Participants were asked to go through an

informed consent form clarifying the study and providing a clear description of any benefits and risks associated with participation and confirm their agreement to participate. The experimental protocol, questionnaire and informed consent were approved by the Institutional Review Board of Imam Abdulrahman Bin Faisal University (IRB-2021-UGS-03-013).

RESULTS

COVID-19 pandemic has induced exceptional conditions that resulted in disruptions in food consumption patterns and restricted people's movements, which has led to a global change in lifestyle and dietary habits. Although the quarantine is a crucial measure to save public health, the outcomes show changes in the actual physical activity and eating practices that can negatively affect health.

Table 1: Comparison of weight changes during and after the lockdown.

	During lockdown N (%)	After lockdown N (%)	P value
Gaining weight			
Yes	123 (41)	73 (24)	0.001
No	177 (59)	227 (76)	
Amount of weight gained (kg)			
5	92 (31)	57 (19)	0.650
6-10	27 (9)	13 (4.25)	
11-15	2 (0.5)	2 (0.5)	
>15	2 (0.5)	1 (0.25)	
Losing weight			
Yes	101 (34)	86 (29)	0.199
No	199 (66)	214 (71)	
Amount of weight lost (kg)			
≤5	82 (27.75)	77 (26)	0.250
6-10	16 (5.5)	9 (3)	
11-15	2 (0.5)	-	
>15	1 (0.25)	-	
Factors that affect weight gain or loss			
Physical activity		25 (8.5)	
Sedentary lifestyle		59 (19.75)	
Stress and anxiety due to COVID-19		58 (19.25)	
Lifestyle change		141 (47.0)	
Availability of food at home		17 (5.5)	

Female students were selected for participation in this study as they form the majority (72%) of students enrolled in the university where the study was conducted. It is also evidenced that females tend to have more food cravings than men, which may increase serotonin levels that positively impacts mood levels, and can be a way to combat stress. This unhealthful dietary pattern could increase the risk of chronic diseases such as obesity, diabetes, and lung disease, which can increase the

complications of COVID-19 in the community.¹⁵ Upon applying the exclusion criteria, a total of 300 students (18-25 years old) completed the online questionnaire. The results in Table 1 showed highly significant association between lockdown and gaining weight ($p<0.001$).

During the COVID-19 pandemic, 65% of participants reported a weight gain and 41% of them gained weight during the lockdown. However, 34% of participants reported a weight loss during the lockdown. Half (50%) of participants reported a weight gain of 5 kg or less, 13% of participants gained 6-10 kg and 1.75% of them gained 11 kg and more. On the other hand, 5.5% of participants lost 6-10 kg, and about 1% reported weight loss of 11 kg or more during the lockdown.

It was suggested that there is a relationship between eating out of control and COVID-19 lockdown. The results of the current study confirmed that significant association (Table 2). Thirteen percent (13%) of participants reported that during the lockdown they do usually eat out of control comparing to 3% before COVID-19, and 42% of participant reported that they sometimes eat out of control during lockdown comparing to 38% before the pandemic ($p<0.029$). The most possible reasons for increasing food consumption and eating out of control might be lifestyle change; availability of food at home (29%), and anxiety due to COVID-19 (19%). However, there was no significant difference between decreased appetite or desire to eat during and after the lockdown.

Table 2: Comparison of food consumption and dietary behavior before COVID-19, during and after the lockdown.

	Before COVID-19, N (%)	During lockdown, N (%)	After lockdown, N (%)	P value
Most of the food consumed				
Food from home	203 (68)	282 (94)	198 (66)	0.954
Outside the house	71 (24)	11 (4)	74 (25)	
Fast food	26 (8)	7 (2)	28 (9)	
Do not want to eat				
Never	132 (44)	150 (50)	130 (43)	0.327
Sometime	154 (51)	122 (41)	149 (50)	
Usually	14 (5)	28 (9)	21 (7)	
Eating out of control				
Usually	10 (3)	40 (13)	24 (8)	0.029
Sometimes	114 (38)	126 (42)	110 (37)	
Never	176 (59)	134 (45)	166 (55)	
Meat consumed daily				
30 g	191 (64)	166 (55)	184 (61)	0.361
60 g	89 (30)	105 (35)	98 (33)	
90 g	20 (6)	29 (10)	18 (6)	
Changed amount of food consumption				
No change	-	114 (38)	151 (50)	0.001
Increase	-	160 (53)	38 (13)	
Decrease	-	26 (9)	111 (37)	
Changes in the type of food				
Meat and meat products	107 (36)			
Coffee and tea	134 (45)			
Fruits and vegetables	103 (34)			
Nuts and seeds	78 (26)			
Grain and bread	111 (37)			
Dairy products	78 (26)			
Nothing	88 (29)			
Supplements				
Yes	117 (39)	142 (47)	134 (45)	0.086
No	183 (61)	158 (53)	166 (55)	
Kind of supplements				
Nothing	188 (39)			
Vit. C	98 (33)			
Vit. D	114 (38)			
Zink	47 (16)			
Others	41 (14)			

Table 3: Comparison of lifestyle activities before COVID-19, during and after lockdown.

	Before COVID-19, N (%)	During lockdown, N (%)	After lockdown, N (%)	P value
Hours spent in front of the screen				
2-4 hours	66 (22)	9 (3)	37 (12)	0.001
5-7 hours	121 (41)	53 (18)	109 (36)	
8-10 hours	91 (30)	115 (38)	93 (32)	
>10 hours	22 (7)	123 (41)	61 (20)	
Enough exposure to sunlight (15-30 minutes)				
Yes	169 (56)	44 (15)	120 (40)	0.001
No	131 (44)	256 (85)	180 (60)	
Number of sleeping hours per day				
4-6 hours	93 (31)	35 (12)	88 (29)	0.492
7-9 hours	165 (55)	135 (45)	162 (54)	
>9 hours	42 (14)	130 (43)	50 (17)	

Table 2 further shows the comparison of food consumption and dietary behaviour before COVID-19, during and after the lockdown. A highly significant difference was found in the amount of food consumed before COVID-19, during and after the lockdown ($p < 0.001$). Fifty three percent (53%) of responders increased their food consumption during the lockdown, while 9% decreased their consumption, and there was no change with 38% of participants.

Table 3 shows comparison of lifestyle activities before the pandemic, during and after the lockdown. There was a relationship between COVID-19 and sunlight exposure ($p < 0.00$). The percent of participants not getting enough sun exposure was 44%, 85% and 60% before the pandemic, during and after the lockdown, respectively ($p < 0.001$). It was also shown that there was a highly significant differences in the time spent in front of screen before COVID-19, during and after the lockdown. Participants who spent more than 10 hours in front of screens increased from 7% before pandemic to 41% during the lockdown and 20% after the lockdown.

DISCUSSION

Food consumption and dietary behaviour

Since corona virus is still hitting the world, this study was conducted to evaluate the changes in lifestyle and dietary habits among female university students and to determine the main reasons for changing the dietary habits during COVID-19 pandemic. The results in Table 2 show a significant difference in the amount of food consumption during and after the lockdown as compared to the situation before COVID-19. Fifty three percent (53%) of participants ate more food during the lockdown. Before COVID-19 the consumption of home-made food was reported by 68% of participants, compared to 24% from outside and 9% eating fast foods. The percentage of participants consuming home-made foods increased to 94% during the lockdown, accompanied by a 4% decrease in the consumption of food from outside, and a decrease in the consumption of fast foods. This might be

attributed to the shift of different educational institutes towards the online mode, and to the lockdown condition that decreased the ability to access food from outside. Another factor might be the perceived risk of COVID-19 or the fear of getting infected with the virus from restaurant workers or delivery staff. These findings come in agreement with those reported by other researchers.^{7,8}

A rise in home cooking corresponded with a reduction in eating ready-made foods was further noticed all over Europe during the pandemic.¹⁶ In a cross-sectional study to identify the influence of different factors related to the COVID-19 pandemic on the changes in food consumption in Denmark, Germany, and Slovenia, Janssen et al attributed the food consumption changes to the restrictions, changes in households' grocery shopping frequency, individuals' perceived risk of COVID-19, income losses due to the pandemic and socio-demographic factors.¹⁷ The observed decrease in fast-food consumption and in the frequency of ordered foods is one of the positive effects of the pandemic and might be an encouraging sign of turning to home-made foods. In a systematic review, including 32 studies, to investigate the impact of COVID-19 lockdown on snacking behaviour, fast-food and alcohol consumption, snacking was found to increase, whereas fast foods and ordered foods showed a tendency towards decrease.¹⁸

Results in Table 2 showed a change in the types of foods consumed during the pandemic as the participants tended to increase their consumption of meats (36% of participants), fruits and vegetables (34%), nuts (26%), grains and bread (37%), coffee and tea (45%), and dairy products (26%), while 29% of participants reported no change. However, COVID-19 confinement in Spain has led to the adoption of healthier dietary habits/behaviours as reflected by a higher adherence to the Mediterranean diet. Participants ($n=7514$) reported decreased intake of fried foods, snacks, fast foods, red meat, pastries or sweetened beverages, but increased olive oil, vegetables, fruits and legumes.¹⁹ It was reported that sales of dietary supplements marketed for immune health increased in the time of COVID-19 since many people thought that these

products might provide some protection from the infection and/or help reduce disease severity for those who develop COVID-19 symptoms.^{20,21} In the current study, the percentage of participants taking supplements increased during the lockdown from 39% to 47%. The increased intake of supplements reported by the responders was attributed to the participants' desire to increase their immunity response to fight the virus. Louca et al investigated whether participants regularly taking dietary supplements were less likely to test positive for COVID-19.²² Results of 372,720 UK participants (175,652 supplement users and 197,068 non-users) showed that those taking probiotics, omega-3 fatty acids, multivitamins or vitamin D had lower risk of COVID-19 infection. The same pattern of association was observed in both the US and Swedish cohorts.

Our results on the dietary behaviour showed a significant relationship between COVID-19 and eating out of control before and during the lockdown ($p < 0.029$) (Table 2). During the lockdown 13% of participant reported usual eating out of control comparing to 3% before COVID-19, and 42% of participant reported that during the lockdown they do sometimes eat out of control, comparing to 38% before COVID-19. The possible reasons reported for eating out of control included psychological aspects due to stress (19%) that had a relative effect in reducing the ability to control the amount of food eaten because of the feeling that eating might relieve the tension. The second reason is the lifestyle change (47%) brought by the pandemic. Before COVID-19, there was an organized system of studying and rest hours and specific times for eating. At the lockdown period, students were shifted to virtual studying through online classes at home. The availability of food at home was another reason that was reported by 29% of responders. This is because of their ability to access food easily and without consciousness of quantities. However, as mentioned earlier, there was no significant association between the pandemic condition and the decrease in appetite or desire to eat during the lockdown.

Weight changes

The results showed that almost half of participants reported weight gain during the lockdown (Table 1). The frequencies of physical activities have decreased, and the sedentary lifestyle, sleeping, availability of food at home, stress, and anxiety due to COVID-19, and screen time have all increased.

Lifestyle changes are known to be a major factor that contributes to gaining weight. Although the study shows a highly significant relation between COVID-19 and gaining weight it did not specify the exact number of weights gained in kilogram as shown in Figure 1. These results are in accordance with those reported by other investigators who reported increased weight gain during COVID-19 pandemic.^{3,5,9} In a review to assess dietary changes during COVID-19 lockdown, 4322 studies were

screened by Bennett et al, where 23 final full-text papers were included.²³ The number of snacks was reported to increase in 10 studies, while six studies found that participants increased their meal number and frequency during quarantine. Positive changes in dietary habits were found in 11 studies with an increase in fresh produce and home cooking and reductions in comfort food and alcohol consumption. However, nine studies found a reduction in fresh produce, with even six studies reporting an increase in unhealthy foods including sweets, fried food, snacks, and processed foods. In eight studies participants reported weight gain and a reduction in physical activity.

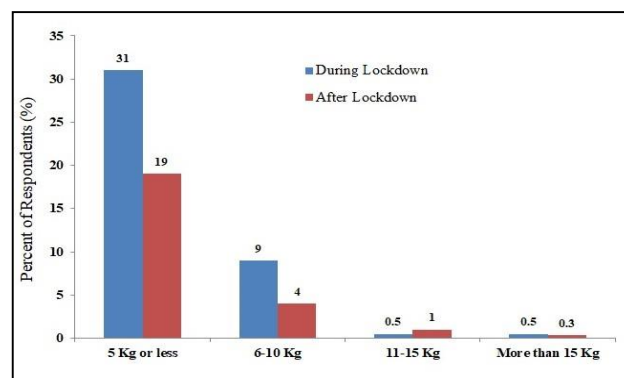


Figure 1: Amount of weight gained (kg) by the study participants during and after COVID-19 lockdown.

Similar results regarding the negative effect of COVID-19 on the PA levels and sedentary lifestyle were reported by other researchers. In a cross-sectional study to estimate the levels of PA, expressed as energy expenditure, among 802 physically active Sicilian participants before and during COVID-19 quarantine, Giustino et al found a significant decrease in the total weekly energy expenditure during the COVID-19 quarantine ($p < 0.001$).²⁴ Martinez-Ferran et al reviewed the literature for studies that have explored the health impacts of reduced PA and modified eating habits.²⁵ They identified the main metabolic consequences as increases in insulin resistance, total body fat, abdominal fat and inflammatory cytokines.

Lifestyle changes

COVID-19 caused a significant decrease in exposure to sunlight (Figure 2), as the percentage of participants not exposed to enough sunlight was increased from 44% before COVID-19 to 85% during COVID-19 ($p < 0.001$). This is expected to contribute to possible vitamin D deficiency. The results also indicated an increase in the time spent in front of screen during the lockdown (Table 3). Forty one percent (41%) of the participants spent more than 10 hours in front of screen, and 38% of them spent 8 to 10 hours in front of the screen. This significant increase in screen time might also be attributed to shifting the teaching style of the university to the online mode during the pandemic. Lectures, exams, presentations, meetings and handing over assignments can only be done

online, which increased the time spent in front of screens. The other contributor is the limited options of entertainment during the lockdown, which led to spending more time in front of screens to watch movies, communicate in social networking applications and other ways of entertainment.

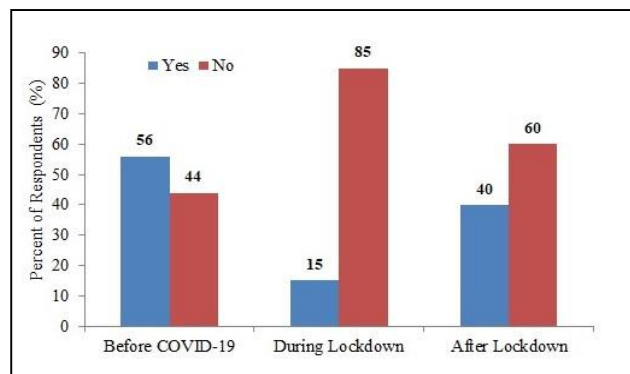


Figure 2: Percentage of participants exposed to proper sunlight (15-30 minutes) before COVID-19 pandemic, during and after the lockdown.

The current study has some limitations, represented in the self-reported online questionnaire that might have led to a sort of data losing or biased responses, and might have consequently impacted the comprehensiveness of the results and the accuracy of the data.

CONCLUSION

In conclusion, the study showed that COVID-19 has negatively impacted lifestyle, dietary habits, sun exposure, screen time, and physical activity, which was associated with significant weight gain among female university students. The original hypothesis of the study is accepted in light of the obtained results. Negative dietary habits were associated with other poor lifestyle outcomes including weight gain, mental health problems, and limited physical activity. These changes, if sustained for long time, may have significant impacts on the health and well-being of the population. Increasing the awareness, healthy dietary plans and physical activity are highly recommended during COVID-19 pandemic.

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