Body mass index, eating habits, and various lifestyle changes in young adults during the two years of the coronavirus disease 2019 (COVID-19) pandemic

Nazish Rafique

Abstract:

BACKGROUND: The aim of this study was to find out the perceived impact of 2 years of coronavirus disease 2019 (COVID-19) pandemic on various lifestyle behaviors (LSBs) and changes and their effect on body mass index (BMI) of young Saudi adults.

MATERIALS AND METHODS: This was a descriptive exploratory study conducted in January 2022 on 1724 students (aged 16–21 years) from multiple colleges of Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia. The main tools of the study were: BMI and an online 30-item LSB and changes structured questionnaire, which assessed LSB and perceived changes, 1 month immediately preceding and 2 years after the COVID-19 outbreak.

RESULTS: Our study results showed that 48% of the subjects gained weight after the pandemic. Screen time (ST) increased from 6.8 h before pandemic to 9.2 h/24 h after pandemic outbreak \( (P < 0.0001) \). However, no significant association was observed between excessive ST and increased BMI. A significant decrease in physical activity was seen after the outbreak \( (P < 0.001) \), which was positively but insignificantly associated with increased BMI \( (P = 0.3) \). A significant increase in the frequency of food intake was observed; 18.7% of the subjects reported taking ≥ 4 meals/day before the epidemic compared to 32.1% during the pandemic \( (P = 0.001) \). Decreased intake of homemade food, increased intake of junk food, and increased number of the meals/day were significantly related with increased BMI \( (P < 0.05) \). The strongest risk factor for increased BMI after the outbreak of the pandemic was ≥4 meals/day \( (OR=1.6; P = 0.048) \).

CONCLUSION: After 2 years of the pandemic, 48% of the young adults perceived they had gained weight, which was strongly associated with self-reported increase in the number of meals/day (≥ 4). These observations could aid the development of nutritional recommendations to maintain the health of young adults during and after the COVID-19 pandemic.

Keywords: Body mass index, coronavirus disease 2019 pandemic, eating behaviors, physical activity, screen usage time

Introduction

Coronavirus is a highly contagious positive single-strand RNA virus that causes severe respiratory symptoms that could lead to death. The virus was named coronavirus disease 2019 (COVID-19) by the WHO on February 11, 2020, and was declared a pandemic on March 13, 2020. The first case of COVID-19 was detected in Saudi Arabia on March 2, 2020. The Saudi government took several quick stringent
measures to control the spread of the virus. All schools and universities were closed, and online teaching began for all students; workplace attendance was suspended; shopping centers were closed, and a ban was imposed on traveling and on all mass gatherings in the entire kingdom. On March 23, 2020, a curfew commencing from 7 pm to 6 am was enforced in all the cities in Saudi Arabia. On June 21, 2020, the curfew was fully lifted, but schools and universities were directed to continue online education.

Almost half of the world’s population has been under “off and on” “full or partial lockdowns” work from home and quarantines since March 2020. Although these worldwide strict preventative regulations helped to control the spread of virus, they adversely affected lifestyle behaviors (LSB) of people worldwide. LSB of student populations has been the most affected as COVID-19 resulted in school closure worldwide. While COVID-19 infection rates in countries differ, currently, more than 186 countries are affected by school closures and have shifted to online teaching. Two of the most recent reviews have raised the serious concerns about the increased screen time (ST), decreased physical activity (PA), negative changes in eating habits, and weight gain in the general population as well as in youngsters after the outbreak of the pandemic.

The WHO has advised people to stay healthy by eating homemade healthy balanced diet. Moreover, it endorsed staying physically active, minimizing SUT, managing stress, and getting enough sleep to improve immune functions.

During the pandemic, young students were expected to experience a maximum change in their LSB and body mass index (BMI), because the pandemic caused most educational sectors all over the world to change from physical to online/hybrid teaching. Most existing studies on young adults have pinned the short-duration effects of the pandemic (4–5 months) on LSB and BMI. Therefore, our aim was to “find out the perceived impact of long duration (2 years) of COVID-19 pandemic on ST, PA, eating habits and BMI of young Saudi adults.” Although an increase in the BMI in young populations after 2 years of the pandemic has been reported in various studies the factors accounting for this change represent a research gap. Therefore, our aim was also to “identify the factors responsible for increased BMI in young adults in the pandemic.”

Materials and Methods

This descriptive exploratory study was conducted in January 2022 on 1815 students from various health colleges of Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia (College of Medicine, College of Clinical Pharmacy, College of Nursing, College of Dentistry, and College of Applied Medical sciences).

The calculation of sample size was done by epidemiologic statistics for public health tools software (accessed at: http://epitools.ausvet.com.au/content.php?page = 1ProportionandProportion). The estimated minimum sample size was 1039 (we recruited 1815 participants, more than the minimum calculated sample size). This calculation was based on the estimated prevalence of increased BMI after COVID-19 pandemic and a target adult population of 1519 in an Italian survey with: Proportion (increased BMI after pandemic) 58%; precision (d) 3%; confidence level 95%.

Ethical approval was obtained from the Institutional Review Board (IRB) vide Letter No. 2022-01-011 dated 10/01/2022, and informed written consent was taken from all participants.

The main tools of this study were: (1) BMI and a 30-item LSB and changes (LSBC) self-administrated structured online questionnaire, which assessed the perceived LSBC “one month immediately before the pandemic” and “the present time, almost 2 years after the COVID-19 outbreak.” This questionnaire was designed by the authors based on various previous studies. The reliability and validity of the questionnaire were confirmed by a test retest technique done on 35 students (P = 0.003; r = 0.80). The component of LSBC, including 7-item International physical activity questionnaire (IPAQ), was not included in the test retest analysis as the reliability and validity of this questionnaire are already established at international level.

The LSBCs questionnaire (LSBCQ) was divided into three different sections assessing screen time (ST), physical activity (PA), and dietary intake as follows: ST was divided into four main categories: Total ST (including the time spent on a mobile, iPad, Laptop, computer, television, and video games); ST for mobile use only; ST for educational purpose only (including the time spent on mobile, iPad, laptop, and computer); ST for entertainment purpose only (including the time spent on mobile, iPad, laptop, computer, television, and video games). The subjects were divided into four categories based on their ST: Low ST ≤2 h/24 h; Medium ST = 3–5 h/24 h; high ST = 6–8 h/24 h; and very high ST ≥9 h/24 h.

PA was assessed by a seven-item IPAQ. Based on IPAQ, the subjects were divided into three main categories [Table 1].
Participants with low PA were categorized as inactive. Subjects with medium and high activity were categorized as active.

Information on food intake included data about the frequency and quality of food taken. The frequency of food was assessed by the number of meals per day, which determined the three main categories the subjects were divided into decreased frequency of food intake = 1 meal/day; Normal frequency of food intake = 2 or 3 meals/day; Increased frequency of food intake ≥ 4 meals/day. The quality of food was assessed by the following eating habits: Intake of junk food (including packaged sweets and baked products, sweet beverages, savory snacks, dressings, sauces, fast food, sugary drinks, and deep-fried food); Intake of homemade food; and Intake of healthy food (including fruits, vegetables, milk, nuts, fish, lean meat, and pulses). Increased intake= ≥5 days/week. Decreased intake = <4 days/week.[21]

The response rate was 43.2%, as 1815/4200 students volunteered to participate in the study. The online LSBCQ was shared with the willing students who completed the LSBCQ and were then called to the physiology laboratory for anthropometric measurements. BMI was calculated by the formula = weight in kg/height in m². Weight was measured in kilograms and height in centimeters. The anthropometric measurements were done by using standard procedures (light clothing, bare feet, empty bowel and bladder, and a minimum of 3 h of fasting). Subjects were categorized into four main groups based on their BMI: underweight (BMI ≤ 18.5); normal weight (BMI ≤ 24.9); overweight (BMI > 25–29.9); and obese (BMI > 30).[24]

Criterion for inclusion was: students between 16 and 21 years willing to participate in the study. Students with any chronic physical or mental illness were excluded from the study. In total, 91 students were excluded, and 1724 selected.

| Physical activity | Cut-off value |
|-------------------|---------------|
| Low               | No activity is reported or Some activity is reported, but not enough to meet category 2 or 3 |
| Moderate          | 3 or more days of vigorous activity for at least 30 min/day or 5 or more days of moderate activity or walking for at least 30 min/day or 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of 600 MET min a week |
| High              | 3 or more days of vigorous activity accumulating at least 1500 MET min a week or 7 days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of 3000 MET min a week |

Data analysis was done by Statistical Package for Social Sciences (SPSS) for Windows, Version 20.0 (IBM, Armonk, Newyork, USA). Demographic data were determined by descriptive statistics. All categorical variables including BMI categories, screen usage time categories, PA, and variables related to food were presented as frequencies and percentages. All continuous data, including BMI and screen usage time were presented as mean and standard deviation. Chi-square test or Fisher’s exact test was used to check the association between variables, t-test or ANOVA was used to compare the mean BMI between different variables. Odds ratios (ORs) with their 95% confidence intervals were measured in multivariate analysis. Statistical significance was set at P < 0.05.

**Results**

The mean age of the study participants was 18 ± 2 years. A comparison of BMI before and after 2 years of the pandemic showed a statistically significant increase after the onset of the pandemic (P = 0.002). There was an increase in the number of overweight (15.7%–16.1%) and obese participants (11.2%–12.9%) and a decrease in the number of underweight participants (16%–14.85%) during the pandemic [Table 2].

Table 2 shows that perceived weight gain was seen in 48%, weight loss in 38%, but only 17.9% participants maintained their weight after 2 years of the pandemic [Figure 1].

Table 3 shows the comparison of ST of the participants before and after 2 years of the COVID-19 pandemic. The average total perceived ST before and during the pandemic was 6.8 ± 2.6 and 9.2 ± 2.2 h/24, respectively. Before pandemic, only 22.7% of the subjects perceived that they had very high ST (≥9). This increased to 68.6% during the pandemic (P = 0.0001).

A comparison of different categories of ST before and after 2 years of the COVID-19 pandemic is also shown in Table 3.

![Figure 1: Food quality taken by subjects during the COVID-19 pandemic](image_url)
A perceived change (decrease) in the PA was seen after
the 2 years (P ≤ 0.001) [Table 4]. The number of inactive
subjects increased from 22.6% before pandemic to 37.9% in
the pandemic (P < 0.001), while the number of active
subjects decreased from 20.7% before pandemic to 11.9% during pandemic (P = 0.001).

A comparison of the frequency of food intake before
and after the outbreak of the pandemic is highlighted
in Table 4. Normal food intake (1–3 meals/day) was
documented by 81.3% of the subjects before and 67.9% of subjects after the outbreak. There was a
perceived significant increase in the frequency of food
intake, as before pandemic only 18.7% of the subjects
took ≥4 meals/day. This increased to 32.1% in the
pandemic (P = 0.001).

Figure 1 provides the information about the quality of food
taken by the subjects during the COVID-19 pandemic.
There was perceived increase in homemade food (55.2%)
and healthy food (37%), whereas no significant change
was perceived in the intake of junk food.

Table 2: Comparison of body mass index of study
participants before and during the COVID‑19 epidemic
(n=1724)

| BMI          | 1 month immediately before pandemic | 2 years after the pandemic | P-value*
|--------------|-------------------------------------|---------------------------|---------
| Mean BMI     | 23.3±5.9                            | 23.6±5.9                  | 0.002   |
| Underweight  | 276 (16.0)                          | 256 (14.8)                | 0.32    |
| Normal weight| 984 (57.1)                          | 968 (56.1)                | 0.55    |
| Overweight   | 271 (15.7)                          | 278 (16.1)                | 0.7     |
| Obese        | 193 (11.2)                          | 222 (12.9)                | 0.12    |

*P ≤ 0.05 is statistically significant. Underweight=BMI ≤ 18.5 kg/m², Normal
weight=BMI ≤ 24.9 kg/m², Overweight=BMI 25-29.9 kg/m², Obese=BMI
≥ 30 kg/m². BMI=Body mass index

Univariate analysis [Table 5] showed that increased
BMI was significantly related to increased frequency of
food intake (P < 0.001), decreased intake of homemade
food (P = 0.023), and decreased intake of healthy
food (P = 0.044) (perceived changes).

Multivariate logistic regression analysis [Table 6] revealed
that subjects whose PA decreased, whose frequency of
food intake rose, intake of junk food increased, and intake
of homemade food reduced (perceived changes) had
1.3 times, 1.6 times, 1.2 times, and 1.5 times increased OR
of having increased BMI. However, the only factor which
showed a significant P value was perceived increased
frequency of food intake (P = 0.048). This indicates that
increased frequency of food intake is the strongest factor
responsible for increased BMI 2 years after the pandemic
outbreak in our study population.

Discussion

This study identified the impact of 2 years of COVID-19
pandemic on various LSB and their effects on BMI of
young Saudi adults. There was weight gain in 48%
of our young adults. Similar findings were reported
by the pooled results of two meta-analysis (including
almost 100 studies worldwide), COVID-19 pandemic
lockdowns led to body weight gain (P < 0.00001) in a
significant number of children and young adults (11.1%–
72.4%).[25,26] The major contributor for increased BMI in
young populations was a shift from physical to online
education, resulting in increased: ST, sleeping hours,
sitting hours, and the number of meals/day, resulting
in the increasing trend of overweight and obesity.[25,26]

This study also aimed to identify the factors responsible
for increased BMI in our study population. Almost all...
Table 4: Comparison of physical activity and frequency of meals per day among study participants before and during COVID-19 disease (n=1724)

| Lifestyle behaviors | N (%) | BMI Mean±SD | P-value |
|---------------------|-------|-------------|---------|
| 1 month immediately before pandemic | 2 years of the pandemic | |

| PA | N (%) | BMI Mean±SD | P-value |
|----|-------|-------------|---------|
| Low | 390 (22.6) | 23.72±4.24 | 0.8 |
| Moderate | 288 (16.7) | 23.53±5.99 | 0.9 |
| High | 69 (4.0) | 23.13±6.26 | 0.052 |

| Food frequency | Normal | High | P-value |
|----------------|-------|------|---------|
| 1402 (81.3) | 1171 (67.9) | 23.72±4.24 | 0.001 |

Table 5: Comparison of mean body mass index of the study participants before and during the COVID-19 epidemic by various lifestyle behaviors (n=1724)

| Lifestyle behaviors | N (%) | BMI Mean±SD | P-value |
|---------------------|-------|-------------|---------|
| SUT | Normal | 96 | 23.72±4.24 | 0.8 |
| High | 1628 | 23.53±5.99 | 0.9 |

| Frequency of food intake | Normal | High | P-value |
|--------------------------|-------|------|---------|
| 1171 | 23.13±5.71 | 0.001 |

| Junk food | N (%) | BMI Mean±SD | P-value |
|------------|-------|-------------|---------|
| Increased | 611 | 23.98±6.27 | 0.11 |
| Decreased | 562 | 23.42±5.39 | |

| Healthy food | N (%) | BMI Mean±SD | P-value |
|--------------|-------|-------------|---------|
| Increased | 639 | 23.45±5.06 | 0.044 |
| Decreased | 255 | 24.53±7.29 | |

P<0.05 is statistically significant. SUT=Normal SUT ≤5 h/24 h, High SUT=≥6-8 h/24 h, PA=categorized based on IPAQ. Low activity was categorized as inactive, whereas medium and high activity was categorized as active group. Frequency of food intake: Normal food intake=2 or 3 meals/day. Increased food intake=≥4 meals/day. IPAQ=International Physical Activity Questionnaire, PA=Physical activity. * in all the values which have a significance below 0.05

The results of this study also showed a significant reduction in the PA of the students, which was positively but insignificantly associated with increased BMI. Similar findings were reported in a study done in the initial months of COVID 19 lockdown (March–May 2020) on 10 121 participants from 67 countries, in which 31.25% of the young inactive population reported weight gain. Although our study was conducted almost 2 years after the onset of the pandemic, the number of inactive young adults had risen to 37.9%, while the number of active subjects had fallen to 11.9%, indicating that the unhealthy lifestyles adopted during the initial months of pandemic, were still in practice resulting in weight gain and obesity in the young adults.

This study also documented the changes in the eating habits of the young adults and their effects on BMI. It was observed that during the pandemic, there was an increase in homemade food (55.2%). The study results of Randah and Husain et al., also revealed a rise in home cooking during the pandemic. This may be due to the increase in the time spent at home as most people worked from home during the pandemic. Moreover, 37% of our study participants reported an increased intake of healthy food (including fruits, vegetables, milk, nuts, fish, lean meat, and pulses), during the pandemic. Our results contradict the findings of most other studies in which more fast food, sweet beverages, savory snacks, sugary drinks, and deep-fried food were reported to have been consumed during the pandemic. This dissimilarity may be because our study population included students from the health science colleges who appreciated the fact that eating healthy food during the pandemic could boost their immune systems and provide protection against the COVID-19 infection.
those subjects whose intake of homemade and healthy food fell showed weight gain and had 1.2 and 1.5 times increased OR of having increased BMI. This is in accord with the fact that a high intake of fats, sugars, and junk food can lead to weight gain and various other health issues.[38]

The most important finding of the current study was that the increased number of meals/day (≥4), the strongest risk factor associated with increased BMI, could lead to 1.6 times increased OR of weight gain. There was a significant rise in the frequency of food intake. Before pandemic only 18.7% of our subjects had ≥4 meals/day, but this increased to 32.1% after pandemic outbreak. Increased consumption of food during the pandemic has also been reported by various other studies.[34] Randha pointed out that during the pandemic, 58% of their study participants reported eating more; 86.0% of the respondents of the Ismail et al., study reported that they were unable to control their diet during the pandemic. This could be the result of the increased period of stay time at home, enhanced exposure to food because of boredom, having more time available to cook and eat, emotional eating, and negative moods that result in comfort eating.[35,36] Increased frequency of food intake, together with decreased PA might have affected the energy balance in our young adults because when energy intake exceeds energy expenditure, a state of positive energy balance occurs resulting in increased BMI.[38] Wang et al., estimated that excessive weight gain can be prevented in children and adolescents by reducing positive energy balance by about 150 kcal/day.[39] Consequently, young adults should be motivated to increase their PA, adopt healthy eating habits, and keep a check on their daily caloric intake. These measures can help to minimize the impact of COVID-19 pandemic on BMI and LSB of young adults.

The data shows that stricter measures/lockdowns and curfews imposed in the first 4 months of the pandemic (March 2020–June 2020) compelled people to remain at home. During this period, there was a drastic negative shift in the LSB and eating habits in populations worldwide. However, when most of the restrictions were lifted after June 2020, and parks and shopping malls reopened, and most business and office activities resumed, physical classes for students did not resume. Most educational institutions continued online teaching, as a result of which the unhealthy lifestyles adopted during the initial periods of pandemic remained and ultimately turned into habits for young adults, and still remain 2 years on in the pandemic.

## Conclusion

There was a perceived significant change in the lifestyle and behavior of young Saudi students during the pandemic. This included weight gain (48% of the population), increased screen usage time, decreased PA, and increased food intake (≥4 meals/day). Although there was a perceived increase in the consumption of homemade and healthy food during the pandemic, no significant change was seen in the intake of junk food before and in the pandemic. Reduced intake of homemade food, increased intake of junk food, and increased number of the meals/day were significantly related with increased BMI. However, perceived rise in the number of meals/day (≥4) was the strongest risk factor associated with increased BMI, that could lead to 1.6 times increased OR of weight gain.

## Acknowledgment

The authors are thankful to the volunteer participants of the study.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

1. Paules CI, Marston HD, Fauci AS. Coronavirus infections-more than just the common cold. JAMA 2020;23:126-34.
2. Mahase E. China coronavirus: WHO declares international emergency as death toll exceeds 200. BMJ 2020;368:m408.
3. Listings of WHO’s Response to COVID-19; 2020.
Available from: https://www.who.int/news-room/detail/29-06-2020-covidtimeline. [Last accessed on 2022 Mar 10].

4. Ministry of Health, Saudi Arabia, MOH Reports First Case of Coronavirus Infection; Published, 2020. Available from: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-03-02-002.aspx. [Last accessed on 2021 Mar 11].

5. Yezli S, Khan A. COVID-19 social distancing in the Kingdom of Saudi Arabia: Bold measures in the face of political, economic, social and religious challenges. Travel Med Infect Dis 2020;37:101692.

6. Algaissi AA, Alharbi NK, Hassanaain M, Hashem AM. Preparedness and response to COVID-19 in Saudi Arabia: Building on MERS experience. J Infect Public Health 2020;13:834-8.

7. Alshammari TM, Altebanawii AF, Alenzi KA. Importance of early precautionary actions in avoiding the spread of COVID-19: Saudi Arabia as an Example. Saud Pharm J 2020;28:898-902.

8. An Approval Issued to Fully Lift the Curfew from 06 am on Sunday, Ban on Umrah, Visit, Int'l Flights to Continue The Official Saudi Press Agency; 2020. Available from: https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2100088. [Last accessed on 2022 Jan 10].

9. World Health Organization. The Current COVID-19 Situation in Saudi Arabia. Available from: https://www.who.int/countries/sau. [Last accessed on 2022 Feb 15].

10. World Health Organization. COVID-19 Public Health Emergency of International Concern (PHEIC) Global Research and Innovation Forum. Available from: https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-(phei)-global-research-and-innovation-forum. [Last accessed on 2022 Feb 10].

11. McCloskey B, Zuñiga A, Ippolito G, Blumberg L, Arbon P, Cicerò A, et al. Mass gathering events and reducing further global spread of COVID-19: A political and public health dilemma. Lancet 2020;395:1096-9.

12. Alreshad S, Min-Allah N, Saxena A, Ali I, Mehmood R. Impact of COVID-19 lockdown. J Multidiscip Healthc 2021;14:1901-10.

13. Zheng C, Huang WY, Sheridan S, Sit CH, Chen XK, Wong SH. COVID-19 pandemic brings a sedentary lifestyle in young adults: A cross-sectional and longitudinal study. Int J Environ Res Public Health 2020;17:6035.

14. Jalal SM, Beth MR, Al-Hassan HJ, Alshealah NM. Body mass index, practice of physical activity and lifestyle of students during COVID-19 lockdown. J Multidiscip Healthc 2021;14:1901-10.

15. Rawat D, Dixit V, Gulati S, Gulati S, Gulati A. Impact of COVID-19 pandemic on lifestyle behaviors in children and adolescents: An international overview. Ital J Pediatr 2022;48:22.

16. Scapaticci S, Neri CR, Marseglia GL, Staiano A, Chiarelli F, Verduci E. The impact of the COVID-19 pandemic on lifestyle behaviors in children and adolescents: An international overview. Ital J Pediatr 2022;48:22.

17. de Faria Coelho-Ravagnani C, Corgosinho FC, Sanches FF, Prado CM, Laviano A, Mota JF. Dietary recommendations during the COVID-19 pandemic. Nutr Rev 2021;79:382-93.

18. World Health Organization. Rolling Updates on Coronavirus Disease (COVID-19). World Health Organization; 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019. [Last accessed on 2022 Feb 15].

19. Woolford SJ, Sidell M, Li X, Else V, Young DR, Resnicow K, et al. Changes in body mass index among children and adolescents during the COVID-19 pandemic. JAMA 2021;326:1434-6.

20. Oraif I, Elyas T. The impact of COVID-19 on learning: Investigating EFL learners’ engagement in online courses in Saudi Arabia. Educ Sci 2021;11:99-108.

21. Izzo L, Santonastaso A, Cotticelli G, Federico A, Pacifico S, Castaldo L, et al. An Italian survey on dietary habits and changes during the COVID-19 lockdown. Nutrients 2021;13:1197.

22. Rafique N, Al-Asoom LI, Alsunni AA, Saudagar FN, Almulhim L, Alkaltham G. Effects of mobile use on subjective sleep quality. Nat Sci Sleep 2020;12:357-64.

23. Craig CL, Marshall AL, Jöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003;35:1381-95.

24. Rafique N, Al-Sheikh MH. Prevalence of primary dysmenorrhea and its relationship with body mass index. J Obstet Gynaecol Res 2018;44:1773-8.

25. Bakaloudi DR, Barazzoni R, Bischoff SC, Breda J, Wickramasinghe K, Chouridakis M. Impact of the first COVID-19 lockdown on body weight: A combined systematic review and a meta-analysis. Clin Nutr 2021;36:227-39.

26. Chang TH, Chen YC, Chen WY, Chen CY, Hsu WY, Chou Y, et al. Weight gain associated with COVID-19 lockdown in children and adolescents: A systematic review and meta-analysis. Nutrients 2021;13:3668.

27. Nagata JM, Abdel Magid HS, Petee Gabriel K. Screen time for children and adolescents during the coronavirus disease 2019 pandemic. Obesity (Silver Spring) 2020;28:1582-3.

28. Wiederhold BK. Children’s screen time during the COVID-19 pandemic. Boundaries and etiquette. Cyberpsychol Behav Soc Netw 2020;23:359-60.

29. Zahedi S, Jaffer R, Iyer A. A systematic review of screen-time literature to inform educational policy and practice during COVID-19. Int J Educ Res Open 2021;2:100094.

30. Dumith SC, Garcia LM, da Silva KS, Menezes AM, Hallal PC. Predictors and health consequences of screen-time change during adolescence-1993 Pelotas (Brazil) birth cohort study. J Adolesc Health 2012;51:S16-21.

31. Urzuela C, Duclos M, Chris Ugboffi U, Bota A, Berthon M, Kulik K, et al. COVID-19 lockdown consequences on body mass index and perceived fragility related to physical activity: A worldwide cohort study. Health Expect 2022:25:522-31.

32. Hussain W, Ashkanani F. Does COVID-19 change dietary habits and lifestyles behaviours in Kuwait. Health Prev Med 2020;13:1-5.

33. Randah MA. Changes in nutritional habits and lifestyles during the COVID-19 lockdown period in Saudi Arabia. Curr Res Nutr Food Sci 2021;12:162-78.

34. Ismail IC, Osaili TM, Mohamad MN, Al Marzouqi A, Jarrar AH, Abu Jamous DO, et al. Eating habits and lifestyle during COVID-19 lockdown in the United Arab Emirates: A cross-sectional study. Nutrients 2020;12:3314.

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

36. Di Renzo L, Gualtieri P, Cinelli G, Bigioni G, Soldati L, Attinà A, et al. Psychological aspects and eating habits during COVID-19 among healthy young Saudi women during the COVID-19 pandemic. Nutrients 2020;12:2923.

37. Castaldo L, et al. An Italian survey on dietary habits and changes during the COVID-19 pandemic. Nutrients 2020;12:2923.