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Effect Of COVID-19 On Sleeping Patterns and Its Correlation on Body Weight Gain, Screen Time and Mental Health: A Cross-Sectional Study Among Adolescents in Riyadh

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Abstract

Background: During the COVID-19 pandemic, a rise in unhealthy food consumption occurred because of decreased physical activity and changes in sleeping patterns.

Methods: A cross-sectional study was done in Riyadh City, Saudi Arabia on Saudi parents of children aged 12-18. An online questionnaire assessed physical activity, body weight changes, screen time, sleep patterns, and mental health effects during the lockdown. Participants' mental health status, was assessed by the Patient Health Questionnaire (PHQ-4).

Results: the mean age of participants was 14.98 ± 2.03 years, 27.3%, and 18.2% were overweight and obese during the COVID-19 pandemic. Of them, 53.1% observed weight gain during the lockdown. Only 20.5% were involved in physical activities, 42.3% used smart devices for more than 3 hours daily, 83.8% had increased screen time and 50.6% noticed an increase in sleeping hours. Almost 25% had mild mental health effects, 16.5% had moderate effects and 8.5% had severe mental health effects, 41.8% had anxiety and 21.6% had depression. A non-significant relationship was found between differences in sleeping hours during lockdown and BMI, dietary habits, physical activity, screen time, school performance, psychological states, the prevalence of mental health disorders, anxiety, or depression. Participants with improvement in school performance during lockdown had a significantly higher mean BMI before and during the pandemic, and a higher percentage of those who noticed an increase in the average time screen use during lockdown compared to before.

Conclusions: evaluating the pandemic's long-term consequences on adolescents' behaviors and psychological health is needed.

Keywords: COVID-19, sleeping, weight, screen, mental, Riyadh

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Introduction

The World Health Organization (WHO) announced the COVID-19 pandemic, which is the rapid global spread of an acute respiratory infectious disease that began at the end of 2019 and was caused by the SARS-Cov-2 virus [1]. The sickness spreads quickly through droplets from person to person. COVID-19 is regarded as a serious infectious disease that has killed millions of people worldwide [2].

Strict procedures were put in place globally, mostly by the Saudi Arabian government, in response to the COVID-19 outbreak's rapid growth and rising rates of confirmed infections and deaths, respectively. The goal was to stop the outbreak's spread and maintain control over it [3]. These policies, which called for work-from-home options, homeschooling, closing fitness centers and other community-related establishments, and social alienation, drastically altered people's daily routines and lifestyles. Numerous research that looked into the patterns and behavioral shifts during the COVID-19 lockdown found that sedentary behavior, decreased physical activity, and increased in-home stays were among the lifestyle changes [4].

Significant alterations in routine and lifestyle were suggested to have an impact on health [5,6]. These included modifications to sleeping patterns and sleep quality [5,6,7], as well as significant adjustments to dietary practices and body mass index [8].

Due to less hours of sleep in parallel with various day routines from scheduling and working from home, sleep patterns were shown to shift in quality, allowing for greater flexibility in working or studying hours [8]. Additionally, it has been demonstrated that poorer sleep quality is linked to higher levels of anxiety and sadness in those who were previously under lockdown as well as apprehension about the COVID-19 virus's unknown acceleration [6].

Reduced sleep and varying sleep duration have also been linked to an increase in digital usage and screen time [9]. These factors were also demonstrated to be significantly rising during the previous lockdown because of homeschooling and remote work, as well as the closure of all other time-consuming facilities [4].

As previously mentioned, lower sleeping quality is associated with lower mental health due to the effects of depression and anxiety [4,5]; this correlation is found to be interactive, where higher levels of anxiety and depression act as a barrier to rest and sleep, and lower sleeping hours due to fluctuating sleeping patterns increase the likelihood of experiencing depressive and anxious states. [5].

A person's state of health and well-being depends on their ability to rest and sleep, and studies have shown that poor sleep quality can worsen various health-related conditions like body mass index, eating habits, and mental health [4]. Therefore, during the pandemic lockdown, eating patterns and sleeping patterns have been extensively researched. The findings showed that during the lockdown, a rise in the consumption of unhealthy foods was more prevalent because of decreased levels of physical activity, stays at home for work, school, or leisure, as well as changes in sleeping patterns that disrupted people's regular

mealtime routines [5]. When compared to the pre-pandemic and lockdown conditions, all of these circumstances led to a path of bad eating habits that increased body mass index during the pandemic [10]. In addition to altered sleep patterns, one factor influencing these changes in BMI and eating habits is the rising amount of screen time, which has been demonstrated to rise sharply both before and after the pandemic [6].

It is predicted that the public will suffer long-term effects from increased screen time during the COVID-19 lockdown and sleep disruptions [6]. This change in lifestyle is seen to endure after the pandemic lockdown and is not associated with the lockdown itself. Thus, examining these factors is required to lessen the long-term impact and provide substitute strategies for enhancing public health, given that dietary habits, screen time, body mass index, and sleeping patterns are all critical components of an individual's quality of life and well-being. In addition, universal healthcare and quality of life policies ought to be modified in the event of future pandemics.

The aim of this study was to assess self-reported sleeping pattern changes among adolescents in Saudi Arabia- Riyadh during back COVID-19 lockdown and examine these changes' correlation with body mass index increase, eating habits changes, and screen time increase usage.

Subjects And Methods

Study design, location, and time frame:

A cross-sectional observational, analytical study was done in Riyadh City, Saudi Arabia from the time from 1st of January to the 1st of October 2022.

Study participants:

The inclusion criteria were Saudi parents of children of both genders between 12-18 years, Willing to participate, and were able to fully understand and comprehend the survey questions. The exclusion criteria were parents of children aged above 18 years or below 12 years.

Data collection:

Data was collected by the researcher using an electronic online structured validated questionnaire, developed by the authors of the study. In cooperation with the school administration to reach the adolescents, The questionnaire was sent via social media (Telegram, WhatsApp). The study survey was filled out by the participants who consented to participate in the study. The questionnaire assessed a range of lifestyle behavior changes including physical activity, body weight changes, screen time, and sleep patterns, as well as mental health effects during the lockdown. All questions were structured to be answered directly compared to "before" or "during" confinement conditions.

The questionnaire was translated from English to Arabic and back-translated from Arabic to English by two bilingual experts. To assess the participants' mental health status, the four-item patient health

questionnaire (PHQ-4) was used to determine the presence of anxiety and depression. The total score is determined by adding together the scores of each of the 4 items, where scores are rated as normal (0-2), mild (3-5), moderate (6-8), and severe (9-12). A Total score ≥3 for the first 2 questions suggests anxiety and total score ≥3 for the last 2 questions suggest depression [11].

Validity and reliability analysis:

Questions in the study questionnaire covered the effect of the COVID-19 pandemic on sleeping patterns and its correlation with body weight gain, screen time, and mental health. The survey items were adapted from previous studies [6,12,13,14]. Eighteen participants were involved in a pilot study, and the results were utilized to analyze reliability and validity.

Questionnaire validation assessment:

The validity of the questionnaire was assessed by a panel of three experts. The experts altered the initial items to check if they were suitable for evaluation. The task given to the subject matter experts was to rate each item on a 4-point scale based on its suitability and relevance. If the questionnaire item was adequate (simple, relevant, and clear) it was given a score of "4", if was adequate but needed minor revision it was given "3", if needed major modification a score of "2" was give, while a score of "1" was given if the item was not so adequate (can be omitted). The percentage of all items according to the experts is known as the content validity index (CVI). A value of 80% of the CVI indicates that the questionnaire has good validity. The CVI of the study questionnaire was determined and found to be 91.6%.

Assessment of the questionnaire reliability:

The Cronbach's alpha value of the study questionnaire was 0.83. Any scale is considered internally consistent when the Cronbach's alpha value is larger than 0.7 [15].

Data analysis:

Data were statistically analyzed using the (SPSS) application version 26. To investigate the association between the variables, the Chi-squared test ($\chi 2$) was applied to qualitative data that was expressed as numbers and percentages. Quantitative data was expressed as mean and standard deviation (Mean ± SD), where the Kruskal Wallis test was applied for non-parametric variables. Correlation analysis using the Spearman's test was done, and a p-value of <0.05 was considered as statistically significant.

Ethical considerations:

Ethical approval for the study was abstained from the research ethics committee of King Saud Medical City Research Center, Saudi Arabia.

Results

Of the studies 352 participants, the mean age was 14.98 ± 2.03 years and 69.6% were females. Of them, 9.9% had chronic diseases, with asthma the most common (48.7%). Only 4.5% had neuropsychiatric disorders, with depression (44%) the most common. Of the participants, 25.3% and 15.3% were overweight and obese before COVID-19 pandemic, compared to 27.3% and 18.2% during the pandemic respectively. The mean BMI before the pandemic was 24.25 ± 6.22 k/m^2, during the pandemic was 25.09 ± 6.5 k/m^2 and the mean increase in BMI during the pandemic compared to before was 0.83 ± 1.4 k/m^2.

Table 1. Distribution of studied participants according to their demographics, chronic diseases, neuropsychiatric disorders, BMI before and during COVID-19 pandemic and mean increase in BMI (No.: 352)

Variable	No. (%)
Age (years) (Mean ± SD)	14.98 ± 2.03
Gender	
Female	245 (69.6)
Male	107 (30.4)
Chronic disease	
No	317 (90.1)
Yes	35 (9.9)
If having chronic disease, specify: (No.: 35)	
CVD	2 (5.7)
Asthma	17 (48.7)
DM	9 (25.7)
Epilepsy	4 (11.4)
Other	3 (8.5)
Neuropsychiatric disorders	
No	336 (95.5)
Yes	16 (4.5)
If having neuropsychiatric disorders, specify: (No.: 16)	
ASD	1 (6.2)
Depression	7 (44)
Anxiety	5 (31.2)
ADHD	1 (6.2)
Other	2 (12.4)
BMI before COVID-19 pandemic	
Underweight	56 (15.9)
Normal weight	153 (43.5)
Overweight	89 (25.3)
Obese	54 (15.3)
BMI before COVID-19 pandemic (mean ± SD) (k/m^2)	24.25 ± 6.22
BMI during COVID-19 pandemic	
Underweight	45 (12.8)
Normal weight	147 (41.8)
Overweight	96 (27.3)
Obese	64 (18.2)
BMI during COVID-19 pandemic (mean ± SD) (k/m^2)	25.09 ± 6.5
Increase in BMI (Mean ± SD) during COVID-19 pandemic(k/m^2)	0.83 ± 1.4

(Table 2) shows that 44.6% of the participants were infected with COVID-19. Of them, 96.9%

strictly adhered to home quarantine, 81.8% avoided social gathering and 49.1% continued in home isolation after quarantine period ends.

Table 2. Distribution of the participants according to COVID-19 infection and isolation circumstances during lockdown (No.: 352)

Variable	No. (%)
Being infected by COVID-19	
No	195 (55.4)
Yes	157 (44.6)
Isolation During Lockdown	
Strictly adhere to home quarantine?	
No	11 (3.1)
Yes	341 (96.9)
Avoiding social gathering?	
No	64 (18.2)
Yes	288 (81.8)
Continue in home isolation after quarantine period ends?	
No	179 (50.9)
Yes	173 (49.1)

As for Dietary Habits during the pandemic, 53.1% of the participants observed weight gaining during the lockdown, and 50% observed increase in dietary consumption of unhealthy food (fast/junk food, canned foods, fried food, sweets and sugars. As for physical activity, only 20.5% were involved in physical activities program before the lockdown and 49.4% were inactive. When asked about their Screen Time habits during lockdown, 42.3% were using the smart devices for recreational purposes for more than 3 hours daily. And 12.2% attended online classes and studying using the school platforms for more than 8 hours daily. The majority (83.8%) Noticed an increase in an average time screen use during lockdown compared to before Covid-19 period. Regarding their school performance, most of the participants continued studying through remote/virtual school during the pandemic and 48% noticed a decrease in their school performance. The mental health state had no changes for 31.5% of the participants during the pandemic, but for 12.8% the symptoms increase (Table 3).

Table 3. Participants dietary habits, physical activity, screen time, school performance and psychological states during lockdown (No.: 352)

Variable	No. (%)
Dietary Habits	
Observe weight gaining during the lockdown?	
No	165 (46.9)
Yes	187 (53.1)
Increase in dietary consumption of unhealthy food (fast/junk food, canned foods, fried food, sweets and sugars)?	
No	176 (50)
Yes	176 (50)
Physical Activity	
Was involving in physical activities program before the lockdown (Gym, Camp, extra school activity)?	

No	280 (79.5)
Yes	72 (20.5)
Physical activity during the lockdown?	
Less than 120 min/week	156 (44.3)
About 60 minutes most of the days across the week	22 (6.3)
Not active	174 (49.4)
Screen Time	
Daily hours of using the smart devices for recreational purposes	
60 minutes daily	75 (21.3)
2-3 hours	128 (36.4)
More than 3 hours.	149 (42.3)
Daily hours to attend online classes and studying using the school platforms (Madrrasti* and Microsoft Teams)	
3-5 hours	181 (51.4)
6-8 hours	128 (36.4)
More than 8 hours	43 (12.2)
Notice increases in an average time screen use during lockdown compared to before Covid-19 period)	
No changes	57 (16.2)
Yes, increase	295 (83.8)
School Performance	
Continue studying during COVID-19 pandemic through:	
Remote/virtual school	286 (81.3)
Combined (Remote and In-person Attendance) in someday	66 (18.8)
Notice changes in the during COVID-19	
No change	87 (24.7)
Improves	96 (27.3)
Decrease	169 (48)
Psychological States	
What is the impact of covid-19 lockdown on your mental health state?	
Not applicable	196 (55.7)
No changes	111 (31.5)
Increase symptoms	45 (12.8)

(Figure 1) illustrates that the majority of the participants (74.4%) noticed a difference in sleeping routine during the home quarantine compared to before.

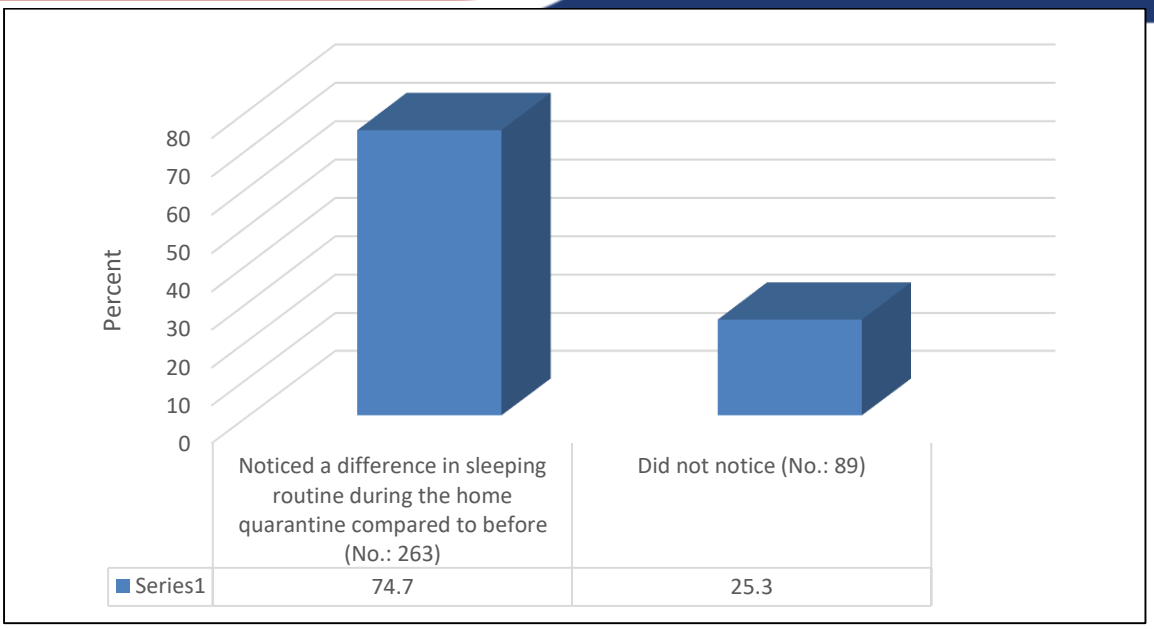


Figure 1. Percentage distribution of prevalence of difference in sleeping pattern during the home quarantine compared to before

Almost half (50.6%) noticed an increase in sleeping hours, while 17.3% suffered from insomnia and staying up for long hours (Figure 2).

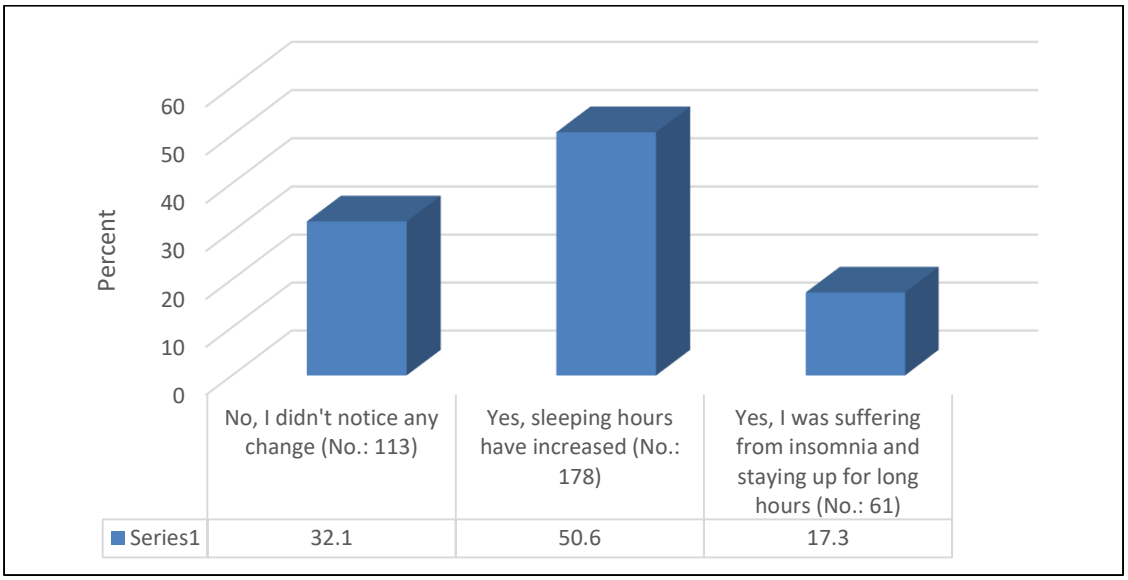


Figure 2. Percentage distribution of prevalence of difference in sleeping hours during home quarantine period compared to before

The mean PHQ score was 3.38 ± 3.94 and the mean anxiety score was 2.12 ± 2.15 and the mean depression score was 1.21 ± 2.04. Based on the PHQ scores classification, 49.1% of the participants were normal, 25.9% had mild mental health effect, 16.5% had moderate effect and 8.5% had severe mental health effect. As for anxiety and depression levels, 41.8% had anxiety and 21.6% had depression (Figure 3 and 4).

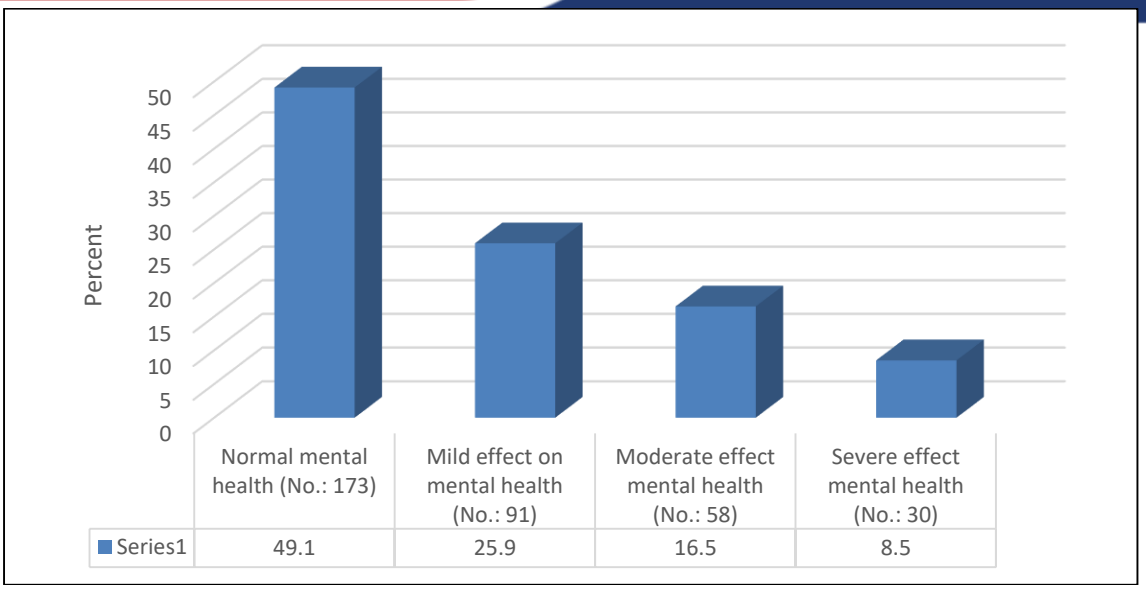
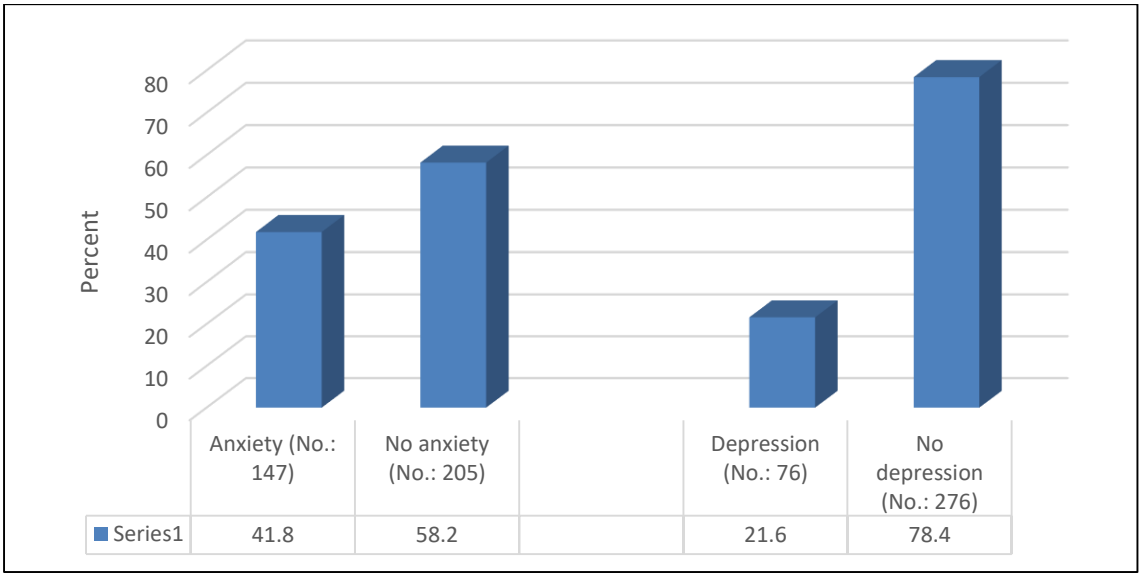


Figure 3. Percentage distribution of prevalence of mental health disorders based on the PHQ score cutoff classification



. Figure 4. Percentage distribution of prevalence of anxiety and depression among studied participants based on the PHQ score cutoff classification

(Table 4) shows that a non-significant relationship was found between difference in sleeping hours during the home quarantine compared to before and BMI before and during COVID-19 pandemic or mean increase in BMI (p=>0.05).

Table 4. Relationship between difference in sleeping hours during the home quarantine compared to before and BMI before and during COVID-19 pandemic and mean increase in BMI (No.: 352)

Variable	Noticed a difference in sleeping hours during the home quarantine compared to before			χ^2	p-value
	No No. (%)	Yes, increased No. (%)	Yes, suffered insomnia and staying up for long hours No. (%)		
BMI before COVID-19 pandemic					

Underweight	15 (13.3)	30 (16.9)	11 (18)	2.52	0.866
Normal weight	48 (42.5)	79 (44.4)	26 (42.6)		
Overweight	29 (25.7)	43 (24.2)	17 (27.9)		
Obese	21 (18.6)	26 (14.6)	7 (11.5)		
BMI before COVID-19 pandemic (mean ± SD)	25.07 6.86	23.93 5.86	23.65 5.93	1.57	0.454
BMI during COVID-19 pandemic					
Underweight	12 (10.6)	25 (14)	8 (13.1)	6.17	0.404
Normal weight	48 (42.5)	70 (39.3)	29 (47.5)		
Overweight	26 (23)	55 (30.9)	15 (24.6)		
Obese	27 (23.9)	28 (15.7)	9 (14.8)		
BMI during COVID-19 pandemic (mean ± SD)	26 7.2	24.68 6.07	24.58 6.29	1.86	0.393
Increase in BMI (Mean ± SD) during COVID-19 pandemic	0.92 ± 1.54	0.75 ± 1.23	0.93 ± 1.19	2.68	0.261

The same non-significant relationship was found between difference in sleeping hours during the home quarantine compared to before and COVID-19 infection or isolation circumstances during lockdown (p=>0.05) (Table 5).

Table 5. Relationship between difference in sleeping hours during the home quarantine compared to before and COVID-19 infection and isolation circumstances during lockdown (No.: 352)

Variable	**Noticed a difference in sleeping hours during the home quarantine compared to before**			**χ^2**	**p-value**
	No No. (%)	Yes, increased No. (%)	Yes, suffered insomnia and staying up for long hours No. (%)		
Being infected by COVID-19					
No	56 (49.6)	104 (58.4)	35 (57.4)	2.31	0.314
Yes	57 (50.4)	74 (41.6)	26 (42.6)		
Isolation During Lockdown					
Strictly adhere to home quarantine?					
No	3 (2.7)	7 (3.9)	1 (1.6)	0.91	0.631
Yes	110 (97.3)	171 (96.1)	60 (98.4)		
Avoiding social gathering?					
No	20 (17.7)	33 (18.5)	11 (18)	0.03	0.983
Yes	93 (82.3)	145 (81.5)	50 (82)		
Continue in home isolation after quarantine period ends?					
No	61 (54)	92 (51.7)	26 (42.6)	2.14	0.342
Yes	52 (46)	86 (48.3)	35 (57.4)		

A non-significant relationship was found between difference in sleeping hours during the home quarantine compared to before and all and dietary habits, physical activity, screen time, school

performance and psychological states during lockdown (p=>0.05) (Table 6).

Table 6. Relationship between difference in sleeping hours during the home quarantine compared to before and dietary habits, physical activity, screen time, school performance and psychological states during lockdown (No.: 352)

Variable	Noticed a difference in sleeping hours during the home quarantine compared to before			χ^2	p-value
	No No. (%)	Yes, increased No. (%)	Yes, suffered insomnia and staying up for long hours No. (%)		
Dietary Habits					
Observe weight gaining during the lockdown?					
No	52 (46)	84 (47.2)	29 (57.5)	0.05	0.975
Yes	61 (54)	94 (52.8)	32 (52.5)		
Increase in dietary consumption of unhealthy food (fast/junk food, canned foods, fried food, sweets and sugars)?					
No	58 (51.3)	86 (48.3)	32 (52.5)	0.42	0.807
Yes	55 (48.7)	92 (51.7)	29 (47.5)		
Physical Activity					
Was involving in physical activities program before the lockdown (Gym, Camp, extra school activity)?					
No	91 (80.5)	143 (80.3)	46 (75.4)	0.77	0.678
Yes	22 (19.5)	35 (19.7)	15 (24.6)		
Physical activity during the lockdown?					
Less than 120 min/week	48 (42.5)	71 (39.9)	37 (60.7)	8.94	0.063
About 60 minutes most of the days across the week	6 (5.3)	12 (6.7)	4 (6.6)		
Not active	59 (52.2)	95 (53.4)	20 (32.8)		
Screen Time					
Daily hours of using the smart devices for recreational purposes					
60 minutes daily	23 (20.4)	38 (21.3)	14 (23)	0.69	0.952
2-3 hours	41 (36.3)	63 (35.4)	24 (39.3)		
More than 3 hours.	49 (43.4)	77 (43.3)	23 (37.7)		
Daily hours to attend online classes and studying using the school platforms (Madrrasti* and Microsoft Teams)					
3-5 hours	48 (42.5)	101 (56.7)	32 (52.5)	5.77	0.217
6-8 hours	49 (43.4)	58 (32.6)	21 (34.4)		
More than 8 hours	16 (14.2)	19 (10.7)	8 (13.1)		
Notice increase in an average time screen use during lockdown compared to before Covid-19 period)					
No changes	18 (15.9)	25 (14)	14 (23)	2.66	0.264

Yes, increase	95 (84.1)	153 (86)	47 (77)		
School Performance					
Continue studying during COVID-19 pandemic through:					
Remote/virtual school	88 (77.9)	150 (84.3)	48 (78.7)	2.17	0.337
Combined (Remote and In-person Attendance) in someday	25 (22.1)	28 (15.7)	13 (21.3)		
Notice changes in the school performance during COVID-19					
No change	23 (20.4)	45 (25.3)	19 (31.1)	31.25	0.537
Improves	34 (30.1)	49 (27.5)	13 (21.3)		
Decrease	56 (49.6)	84 (47.2)	29 (47.5)		
Psychological States					
What is the impact of covid-19 lockdown on your mental health state?					
Not applicable	60 (53.1)	102 (57.3)	34 (55.7)	2.91	0.572
No changes	40 (35.4)	55 (30.9)	16 (26.2)		
Increase symptoms	13 (11.5)	21 (11.8)	11 (18)		

In addition, non-significant relationship was found between difference in sleeping hours during the home quarantine compared to before and the prevalence of mental health disorders, anxiety or depression (p=>0.05) (Table 7).

Table 7. Relationship between difference in sleeping hours during the home quarantine compared to before during lockdown and prevalence of mental health disorders, anxiety and depression based on the PHQ score cutoff classification (No.: 352)

Variable	**Noticed a difference in sleeping hours during the home quarantine compared to before**			**$\chi 2$**	**p-value**
	No No. (%)	Yes, increased No. (%)	Yes, suffered insomnia and staying up for long hours No. (%)		
PHQ levels					
Normal mental health	56 (49.6)	90 (50.6)	27 (44.3)	10.98	0.089
Mild effect on mental health	34 (30.1)	45 (25.3)	12 (19.7)		
Moderate effect mental health	18 (15.9)	29 (16.3)	11 (18)		
Severe effect mental health	5 (4.4)	14 (7.9)	11 (18)		
PHQ (Mean ± SD)	3 ± 3.05	3.24 ± 3.49	4.22 ± 4.12	2.91*	0.233
Anxiety					
No anxiety	66 (58.4)	108 (60.7)	31 (50.8)	1.81	0.403
Anxiety	47 (41.6)	70 (39.3)	30(49.2)		
Anxiety score (Mean ± SD)	2 ± 1.98	2.03 ± 2.15	2.6 ± 2.38	2.98*	0.225
Depression					
No depression	92 (81.4)	140 (78.7)	44 (72.1)	2.03	0.362
Depression	21 (18.6)	38 (21.3)	17 (27.9)		
Depression score (Mean ± SD)	0.99 1.83	1.21 2.07	1.62 ± 2.27	4.63*	0.098

N.B.: * = Kruskal Wallis test

(Table 8) shows that participants who had an improvement in their school performance during

COVID-19 pandemic had a significant higher mean BMI before and during the pandemic, and a higher percent of those who noticed an increase in the average time screen use during lockdown compared to before Covid-19 period (p=<0.05). While participants who had a decrease in their school performance during COVID-19 pandemic had a significant higher mean PHQ scores and higher anxiety scores (p=<0.05).

Table 8. Relationship between school performance during COVID-19 pandemic and BMI, screen time behavior, prevalence of mental health disorders, anxiety and depression and the PHQ scores (No.: 352)

Variable	Notice changes in the school performance during COVID-19			χ^2	p-value
	No change No. (%)	Improves No. (%)	Decrease No. (%)		
BMI before COVID-19 pandemic					
Underweight	20 (23)	10 (10.4)	26 (15.4)	9.31	0.157
Normal weight	40 (46)	45 (46.9)	68 (40.2)		
Overweight	19 (21.8)	23 (24)	47 (27.8)		
Obese	8 (9.2)	18 (18.8)	28 (16.6)		
BMI before COVID-19 pandemic (mean ± SD)	22.46 ± 4.85	25.22 ± 6.71	24.61 ± 6.4	9.37*	**0.009**
BMI during COVID-19 pandemic					
Underweight	19 (21.8)	8 (8.3)	18 (10.7)	13.22	**0.04**
Normal weight	37 (42.5)	42 (43.8)	68 (40.2)		
Overweight	21 (24.1)	23 (24)	52 (30.8)		
Obese	10 (11.5)	23 (24)	31 (18.3)		
BMI during COVID-19 pandemic (mean ± SD)	23.12 ± 5.134	26.16 ± 7.18	25.49 ± 6.55	10.39*	**0.006**
Increase in BMI (Mean SD) during COVID-19 pandemic					
Being infected by COVID-19					
No	52 (59.8)	56 (58.3)	87 (51.5)	2.05	0.357
Yes	35 (40.2)	40 (41.7)	82 (48.5)		
Screen Time					
Daily hours of using the smart devices for recreational purposes					
60 minutes daily	14 (16.1)	27 (28.1)	34 (20.1)	5.7	0.223
2-3 hours	34 (39.1)	36 (37.5)	58 (34.3)		
More than 3 hours.	39 (44.8)	33 (34.4)	77 (45.6)		
Daily hours to attend online classes and studying using the school platforms (Madrrasti* and Microsoft Teams)					
3-5 hours	37 (42.5)	58 (60.4)	86 (50.9)	6.37	0.173
6-8 hours	37 (42.5)	27 (28.1)	64 (37.9)		
More than 8 hours	13 (14.9)	11 (11.5)	19 (11.2)		
Notice increase in an average time screen use during					

lockdown compared to before Covid-19 period)					
No changes	23 (26.4)	12 (12.5)	22 (13)	8.94	**0.011**
Yes, increase	64 (73.6)	84 (87.5)	147 (87)		
PHQ levels					
Normal mental health	43 (49.4)	54 (56.3)	76 (45)	9.56	0.144
Mild effect on mental health	22 (25.3)	26 (27.2)	43 (25.4)		
Moderate effect mental health	18 (20.7)	8 (8.3)	32 (18.9)		
Severe effect mental health	4 (4.6)	8 (8.3)	18 (10.7)		
PHQ (Mean ± SD)	3.01 ± 3.24	2.75 ± 3.35	3.84 ± 3.64	7.47*	**0.024**
Anxiety					
No anxiety	52 (59.8)	63 (65.6)	90 (53.3)	3.96	0.138
Anxiety	35 (40.2)	33 (34.4)	79 (46.7)		
Anxiety score (Mean ± SD)	1.89 ± 2.15	1.7 ± 2.03	2.47 ± 2.17	9.49*	**0.009**
Depression					
No depression	71 (81.6)	76 (79.2)	129 (76.3)	0.99	0.61
Depression	16 (18.4)	20 (20.8)	40 (23.7)		
Depression score (Mean ± SD)	1.11 ± 1.94	1.04 ± 2.02	1.36 ± 2.1	3.16*	0.206

N.B.: * = Kruskal Wallis test

Discussion

Considering the stringent measures being implemented globally to mitigate the COVID-19 pandemic, it is crucial to acknowledge that these actions were precipitous, lacking adequate planning or prior experience in enacting such drastic changes at the local and international levels in Saudi Arabia [16]. Furthermore, no obvious projections of future outcomes based on similar past events were present. The implementation of the universal home quarantine resulted in several notable developments that adversely impacted the people's quality of life during this period [17]. These included closing time-consuming and recreational amenities as well as introducing work-from-home regulations and homeschooling. Many parts of people's lives influence their daily routines, such as eating habits, sleeping patterns, physical activity, academic success, and, in the end, psychological health [18,19,20].

This study sought to assess the relationship between sleep patterns and academic performance changes in adolescents (12–18 years old) and psychological well-being, screen usage, and body mass index. The adoption of home quarantine measures, which include limiting direct social involvement and spending a lot of time at home, is expected to have long-term impacts on the sleeping patterns and academic performance of adolescents in this age range [12]. It's likely that this effect extends beyond the COVID-19 epidemic. As a result, all kids are now required to use smart devices for studying due to the significant changes in teen culture, particularly in the domain of education. These changes include the adoption of electronic learning, homeschooling, and altered class schedules. More people are utilizing screens for extended periods of time as a result [21, 22, 23].

According to 2023 research assessing the pandemic's long-term effects on sleep issues, all of the aforementioned adjustments may still affect sleep habits in various ways following the lockdown period

[24]. Our research thus revealed notable alterations in sleeping patterns (74.7%) that fell between hypersomnia and insomnia when compared to the period prior to the pandemic. This conclusion is supported by related studies that investigate how sleep habits changed during the COVID-19 pandemic [25, 26].

It's noteworthy that, in our survey, the frequency of hypersomnia—defined as expanding during the sleeping hours—was found to be higher than that of insomnia—defined as decreasing during the sleeping hours—which was recorded in only 17.3% of cases. Our results were in line with a Taiwanese study [26]. This discovery contradicts the results of earlier research, which often indicate that participants in those trials had a notable prevalence of insomnia [25, 26, 27].

To assess any potential associations between these characteristics and modifications in sleep patterns and academic performance during the outbreak, we also included other variables like BMI, screen time, and psychological state in our research. The body mass index (BMI) of the study was impacted by weight increase. The BMIs of slightly more than 51% of the individuals increased throughout the lockdown. That's because a higher percentage of participants—nearly half—ate unhealthy foods like junk food, fast food, canned goods, fried food, and sweets and sugars. Additionally, 83.8% of individuals showed a significant increase in screen time, which is linked to a high body mass index. These results are consistent with earlier studies that examined the relationship between BMI and a pandemic-related sedentary lifestyle [28, 29, 30].

Teenagers who spend too much time on screens will be less active, eat more unhealthy foods, and eventually have a higher body mass index (BMI), per a Saudi study on school-age youngsters [31]. These findings align with previous studies investigating the relationship between changes in weight and screen time and the COVID-19 pandemic. Our findings regarding the psychological well-being of teenagers during the lockdown indicate that 50.9% of participants reported feeling emotionally uncomfortable. This was determined by analyzing the PHQ-4 scores, which revealed that, among participants, 25.9% and 8.5%, respectively, experienced mild to severe mental health repercussions. These results aligned with earlier studies conducted on the topic [21].

Additionally, anxiety was higher in teenagers than melancholy, which is consistent with previous studies on the psychological health of children and teenagers during the lockdown [22, 32]. Further research revealed no statistically significant correlation ($P >= 0.05$) between alterations in sleeping patterns and BMI, screen time, and psychological state. This finding contradicts other studies that discovered a clear link between changed sleep patterns—including those pertaining to quality—and increased anxiety levels during the pandemic [33, 34]. Additionally, there is a statistically insignificant correlation between

sleeping habits and academic achievement, which is in line with research on university students in Iran [35]. The disparities in results between studies could be caused by a variety of factors, such as the age group under investigation—in our case, teenagers aged 12 to 18—the study design, the timing of the research, and other factors.

Furthermore, the academic performance of the participants during the lockdown proved that, as was already established, Saudi Arabia had to change its approach to teaching during an outbreak in order to maintain distance and ensure that classes continued. Both educators and pupils had to pick up brand-new teaching methods as a result. The massive and poorly thought-out transition from traditional classroom instruction to electronic online learning has a big influence on students' academic success. The impact of the COVID-19 epidemic on children's and adolescents' academic performance has been the subject of numerous studies. Several studies have consistently shown that there is a substantial drop in their performance levels, which results in an unpleasant experience. [36, 37]. In this study, we found about (48%) of participants noticed a negative impact on their school performance, whereas (27.3%) and (24.7%) showed improvement and no change in their level, respectively.

Interestingly, we found a robust statistical relationship ($P <= 0.05$) between better teenage educational attainment and a higher BMI both before and after the pandemic. In addition to spending more time in front of screens, these teenagers also had higher aspirations for academic success, and there is a connection between screen time and technological learning. A higher BMI and a reduced ability for physical exercise account for this [38, 39].

Limitations

One of the study's limitations was the self-administered questionnaire, which may have contributed to recollection bias. Furthermore, by using a cross-sectional study design, it is possible to identify the connections between variables without drawing conclusions about their chance relationships.

Conclusion

This study, along with others conducted in Saudi Arabia or throughout the world, focused on the negative impacts of COVID-19 on adolescents' daily lives, particularly in relation to sleep patterns and academic achievement. The study's conclusions make us consider coping strategies that can improve children's and teenagers' overall quality of life in the case of a global pandemic in the future. Furthermore, many damaging policies can be avoided across a variety of age groups by drawing inspiration from the results of the conducted study. This is due to the extensive documentation of our experience assessing several aspects of population life. We also recommend evaluating the pandemic's long-term consequences

on adolescents' behaviors and psychological health, since its effects might extend beyond the COVID-19 period. Consequently, we are able to monitor any negative effects and respond promptly to address them.

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