

The Impact of COVID-19 Quarantine on Lifestyle, Cognitive Function, Overweight, and Sleep Quality of Children and Adolescents

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ABSTRACT

Objective: The current study investigated the impact of COVID-19 on lifestyle and cognitive function, overweight, and sleep quality among children and adolescents in Abyek city during the quarantine period.

Method: In this study, a descriptive-analytical research method was used, and a combination of stratified and multi-stage cluster sampling was employed for sampling. The study population included 2152 students (1184 girls and 968 boys) from elementary and middle school levels in Abyek city. Data were collected using electronic questionnaires, which were a compilation of the Food Frequency Questionnaire (FFQ localized in 2009), Beck Physical Activity (Beck et al., 1982), Cognitive Function (Nejati et al., 2013), and Pittsburgh Sleep Quality Index, sent online to the students. Subsequently, the collected data were analyzed and examined.

Findings: This study found no significant correlation between students' BMI and their dietary habits or physical activity level ($p > 0.001$, $r_s = 0.45$) as well as between physical activity level and dietary habits or cognitive performance. However, there was a significant positive correlation between sleep quality and physical activity level scores ($p < 0.011$, $r_s = 0.26$), and between cognitive performance and sleep quality ($p < 0.001$, $r_s = 0.49$). Regarding gender differences, male students had a higher Body Mass Index (BMI) and physical activity level compared to female students ($p = 0.018$ and $p < 0.001$, respectively), and there was a significant difference in dietary habits between boys and girls ($p = 0.006$). No significant difference was observed between boys and girls in terms of sleep quality and cognitive performance ($p = 0.180$ and $p = 0.693$, respectively).

Conclusion: According to the study, it appears that changes in diet, physical activity, and sleep quality affect students' cognitive performance during the COVID-19 quarantine. These results indicate that planning to maintain and control physical activity, nutrition, and sleep quality during quarantine is essential to mitigate potential negative effects on students' cognitive performance.

Keywords: COVID-19, lifestyle, cognitive function, overweight, sleep quality.



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1. Introduction

The COVID-19 virus has had significant effects on the lifestyles of individuals, especially children and adolescents, who, due to school closures and quarantine restrictions, have had to spend prolonged periods at home. Changes in lifestyle, including reduced physical activity, poor nutrition, and altered sleep patterns, have led to negative outcomes on mood, decreased cognitive performance, and increased overweight and obesity (Chen et al., 2020; Wang et al., 2020). Research evidence indicates that school closures and quarantine restrictions during COVID-19 have had significant negative impacts on elementary and high school students (Viner et al., 2020; Yarmohammadi et al., 2021). Furthermore, studies show that increased indoor time, decreased physical activity, and increased consumption of high-fat and high-sugar foods have led to an increased likelihood of overweight and obesity in this age group (Pearson & Biddle, 2011).

Additionally, students without access to educational facilities are drifting away from maintaining their cognitive performance levels (Engzell et al., 2020; Kuhfeld et al., 2020). On the other hand, Gao et al. (2021) demonstrated that the outbreak of COVID-19 has reduced the quality of life related to the mental health of children (Haines et al., 2016; Sahoo et al., 2015). Therefore, examining the impacts of lifestyle changes based on physical activity, proper nutrition, and adequate sleep on cognitive performance, overweight, and obesity in elementary and high school students during the COVID-19 home quarantine appears necessary. Lifestyle includes healthy and unhealthy habits, many of which are formed during childhood and adolescence and extend into later life stages (Waters et al., 2011). Modifying lifestyle with the aim of changing and improving dietary habits, physical activity, and behaviors affecting overweight and obesity is associated with risk factors such as cardiovascular diseases (Barrett et al., 2018; Sakane et al., 2023). In this regard, strategies such as raising awareness about dietary habits and activity, modifying and controlling triggers affecting eating, developing principles and skills for eating control, and encouraging and motivating weight stabilization and reduction in adolescents are among the strategies that can be used in lifestyle modification (Katterman et al., 2014; Sahoo et al., 2015). A study by Lee in 2020 showed that school closures during COVID-19 have had negative effects on the mental health of students (Lee, 2020). Jiang also showed in 2020 that school closures during COVID-19 have increased the likelihood of overweight and

obesity in children and adolescents (Jensen et al., 2014). Based on these studies, it can be concluded that school closures and quarantine restrictions during COVID-19 have led to decreased physical activity, poor nutrition, and changes in sleep patterns, and these changes have increased the likelihood of overweight, obesity, and decreased cognitive performance. In this situation, promoting a healthy lifestyle that emphasizes physical activity, proper nutrition, and adequate sleep is important to reduce the negative impacts of quarantine measures on the health and well-being of children and adolescents. This research project aimed to investigate the impact of lifestyle changes during the COVID-19 pandemic on overweight and obesity among fourth, fifth, sixth, seventh, eighth, and ninth-grade students in middle schools in Abyek city. In this study, lifestyle changes with an approach to physical activity, nutrition, and sleep quality related to the COVID-19 home quarantine were examined for their impact on cognitive performance, overweight, and obesity in elementary and middle school students in Abyek.

2. Methods

2.1. Study design and Participant

The method of this research is descriptive-analytical. The study population included 2152 students (1184 girls and 968 boys) from elementary and middle school levels in the city of Abyek. A combined stratified and multi-stage cluster sampling method was used for sampling. In this method, each educational level was considered a stratum, and within each stratum, there were two sub-strata (boys' and girls' schools). Then, within each sub-stratum, further sub-strata were established based on educational grades. Within each educational grade, a class was randomly selected using cluster sampling, and then a number of students were randomly selected for sampling using systematic sampling. Prior to the commencement of the research, written permission was obtained from the Education Department, and consent was given by school principals and parents for conducting the research. Data were collected using electronic questionnaires that were designed as a compilation of questionnaires on food frequency, physical activity, cognitive function, and sleep quality, and were sent online to the students. Ultimately, the collected data were analyzed and examined.

2.2. Measures

In this research, using standard questionnaires, including the Food Frequency Questionnaire (FFQ), Cognitive Functions Questionnaire, Beck Physical Activity Questionnaire, and Pittsburgh Sleep Quality Index (PSQI), the health, economic, and social status, nutrition and physical activity levels, and sleep quality of the subjects were examined. The questionnaires were sent to the students as a single electronic questionnaire via online platforms. The questionnaire items included personal information (age, gender, educational level, and puberty status) and economic and social information (including family economic status, household size, type of school, and living conditions) as well as information related to anthropometric indices, physical activity levels, dietary changes, cognitive factors, and sleep quality. For measuring weight, a SECA scale with a precision of 0.4 kilograms was used, and for height measurement, a wall-mounted height measure with a precision of 0.9 centimeters was used. Subjects were required to stand upright without shoes against the wall where the height measure was placed, ensuring that their head, shoulders, heels, and buttocks were in a straight line, looking forward, and their height was recorded in centimeters.

2.2.1. Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI), created in 1988 by Buysse and his colleagues at the Pittsburgh Psychiatric Institute, is one of the best tools for assessing sleep quality. It includes 7 sub-scales: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The questionnaire has 91 items scored on a Likert scale from 0 to 3. The validity and reliability of this questionnaire have been examined using Cronbach's alpha and test-retest methods in various studies (Buysse et al., 1989; Habibi et al., 2019; Pucci & Pereira, 2016).

2.2.2. Food Frequency

The Food Frequency Questionnaire (FFQ) is a common method in epidemiological studies for examining nutrition and long-term nutrient intake. Due to its easy application, relatively low cost, and quick estimation of individuals' usual intakes, it has become a usable tool. A study conducted by Mirmiran et al. showed that the FFQ has relative validity and acceptable reliability for major food groups and is

recognized as a suitable tool for determining the intake of food items (Barzin M et al., 2009; Fadakar et al., 2018).

2.2.3. Cognitive Functions

The Cognitive Functions Questionnaire, designed and standardized by Nejati in 2013, includes 34 items and 7 components: memory, inhibitory control and selective attention, decision-making, planning, sustained attention, social cognition, and cognitive flexibility. This questionnaire is generally used to assess cognitive functions in individuals and can be employed in studies investigating the positive and negative effects of various factors on cognitive functions. Additionally, it can be used to examine the impact of educational programs and psychological interventions on individuals' cognitive functions (Nejati, 2013).

2.2.4. Physical Activity

The Beck Physical Activity Questionnaire consists of 16 five-choice items on a five-point Likert scale and is designed to assess individuals' physical activity levels based on their occupation type. It contains 3 subscales: occupational activity, sports activities, and leisure time activities. Each item is assessed on a five-point Likert scale, with higher scores indicating greater physical activity... The validity and reliability of this questionnaire have been confirmed both domestically and internationally. The reliability of the BPAQ has been examined in several studies and is recognized as a reliable tool. In one study, the internal consistency of the BPAQ was high, with Cronbach's alpha coefficients ranging from 0.81 to 0.87 for different subsets. Furthermore, the test-retest reliability of the BPAQ was also high, with intraclass correlation coefficients (ICC) between 0.75 to 0.91 (Sori et al., 2016).

2.3. Data Analysis

In this article, the Kolmogorov-Smirnov test was first used to examine the normality of the data. Then, the data were analyzed using SPSS version 23, and Excel 2013 software was used for graphing. In this research, the Spearman correlation test was used to examine the relationships among the variables. Furthermore, for comparing two independent groups of male and female students in the examined variables with non-normal quantitative scales, the non-parametric Mann-Whitney U test was used.

3. Findings and Results

In this study, 2152 participants took part, including 1184 girls (55.02%) with an average height of 155.42 ± 11.43 cm,

average weight of 48.01 ± 11.41 kg, and 968 boys (44.98%) with an average height of 160.34 ± 14.29 cm, average weight of 52.64 ± 14.00 kg. General information about the participants is provided in [Table 1](#).

Table 1

Descriptive Findings

Research Variables	Female Students	Male Students	Overall
Physical Activity Level (0-5) Score			
Mean	3.53	3.91	3.70
Standard Deviation	0.88	0.94	0.93
Dietary Habit Score (44-308) Score			
Mean	184.95	183.57	184.33
Standard Deviation	13.25	13.09	13.19
Body Mass Index (kg/m ²) Score			
Mean	19.82	20.23	20.01
Standard Deviation	5.25	4.06	4.76
Sleep Quality (0-21) Score			
Mean	5.92 ±	5.06	6.07
Standard Deviation	4.87	6.24	4.96
Cognitive Performance (26-130) Score			
Mean	107.23	107.23	107.19
Standard Deviation	14.63	14.53	14.58

As per [Table 2](#), Spearman's correlation test results showed no relationship between students' Body Mass Index (BMI) with their dietary habits and physical activity levels. However, a significant and positive relationship was found between sleep quality and physical activity levels ($p < 0.011$, $r_s = 0.26$), whereas no such relationship was observed

between cognitive performance and dietary habits or physical activity levels. Additionally, results indicated a significant and positive relationship between physical activity levels and dietary habits ($p < 0.001$, $r_s = 0.45$), and between cognitive performance and sleep quality ($p < 0.001$, $r_s = 0.49$).

Table 2

Spearman Correlation Matrix

Variables	Physical Activity Level	Dietary Habit	Body Mass Index	Sleep Quality	Cognitive Performance
Physical Activity Level	-	0.45	-0.002	*0.26	-0.002
Dietary Habit	0.45	-	-0.03	-0.01	0.02
Body Mass Index	-0.002	-0.03	-	-	-
Sleep Quality	*0.26	-0.01	-	-	-
Cognitive Performance	-0.002	0.02	-	0.49	-

*Significant at the 0.05 level ($p < 0.05$)

**Significant at the 0.01 level ($p < 0.01$)

According to [Table 3](#), concerning the comparison between boys and girls, results showed a significant difference between male and female students in terms of BMI score and physical activity level ($p = 0.018$ and $p < 0.001$, respectively), meaning that male students had higher BMI and physical activity levels compared to female students. A significant difference was also observed between boys and girls in terms of dietary habits score ($p = 0.006$); however, no significant difference was found between male

and female students regarding sleep quality and cognitive performance ($p = 0.180$ and $p = 0.693$, respectively). Overall, it seems that the quarantine imposed during COVID-19 has impacted lifestyle components such as physical activity, nutrition, and sleep quality. Staying home and increased use of electronic devices could lead to decreased physical activity, which alone could lead to students' obesity. In fact, a combination of factors such as low physical activity, poor nutrition, and lack of sleep can

cause obesity; therefore, in these circumstances, students should pursue healthy nutrition, sufficient movement, and improve their sleep quality.

Table 3

The Results of Mann-Whitney U Test

Variable	Mann-Whitney U	Z Score	Two-Tailed Significance
Body Mass Index (BMI)	539,079	-2.37	0.018
Physical Activity	433,276.5	-9.75	$p < 0.001$
Sleep Quality	553,881.5	-1.34	0.180
Cognitive Performance	567,000.5	-0.40	0.693
Dietary Habits	533,557.5	-2.76	0.006

4. Discussion and Conclusion

In this study, the main objective was to investigate the impact of factors such as physical activity, nutrition, and sleep quality on obesity and cognitive performance in students during the COVID-19 quarantine. Based on the results of this study, a significant and positive relationship exists between physical activity levels and dietary habits. This study's changes in dietary habits and physical activity levels during the COVID-19 quarantine have positively impacted their physical activity levels. These results suggest that changes in diet and physical activity levels can be used as strategies to reduce obesity and overweight among students. Moreover, studies have shown that fruit and vegetable consumption and eating breakfast are protective factors against obesity in children and adolescents (Deshmukh-Taskar et al., 2006; Haines et al., 2016; Wang et al., 2013). On the other hand, fast food and processed food consumption are recognized as risk factors for obesity in children (Lobstein et al., 2015; Powell et al., 2015); thus, paying attention to lifestyle behaviors including diet, physical activity, and sleep quality during childhood and adolescence is a key strategy for reducing the risk of future obesity and overweight. According to various studies, dietary and lifestyle behaviors in children and adolescents can act as significant factors in reducing or increasing the risk of obesity and overweight (Kremers et al., 2006; Wang et al., 2013). This study observed a significant and positive relationship between the consumption of fast food and processed foods and an increase in weight and BMI among students. Additionally, fruit and vegetable consumption are considered protective factors against obesity and overweight. In a study by Fadakar et al. (2018) in Rasht city, results showed a significant relationship between eating breakfast, fruit and vegetable consumption, chocolate, fast

food, and legumes with children's nutritional status and the likelihood of obesity (Fadakar et al., 2018). Eating breakfast has been confirmed as a protective factor against obesity and overweight in children. Furthermore, fruit and vegetable consumption is considered a protective factor against obesity and overweight in children (Fadakar et al., 2018). Therefore, attention to dietary and lifestyle behaviors during childhood and adolescence is essential as a key strategy for reducing future obesity and overweight risk. According to the conducted research, results indicated a significant and positive relationship between students' sleep quality and their level of physical activity. Moreover, this research showed that changes in lifestyle behaviors, such as increased physical activity during the COVID-19 quarantine, could impact the sleep quality of elementary and middle school students in Abyek city; thus, paying attention to a healthy lifestyle and regular physical activity can influence students' sleep quality during the quarantine and in normal periods. Additionally, this research suggests that increased physical activity in students may also improve their academic performance. Some theories have addressed the relationship between sufficient sleep and obesity. One of these theories is the effect of insufficient sleep on hormones regulating appetite. For example, reduced sleep may lead to increased levels of the ghrelin hormone, which enhances the feeling of hunger, and also causes a decrease in leptin levels, responsible for appetite control and metabolism laziness (Spiegel et al., 2004; Taheri et al., 2004). This theory has been confirmed in various studies. Another theory is that insufficient sleep can lead to increased stress and nervous tension, which in turn causes increased food consumption and lack of physical activity, both leading to obesity. Additionally, another proposed theory is that sufficient sleep improves body metabolism performance, reducing obesity (Nedeltcheva et al., 2010; Spiegel et al., 2004).

Based on this study's results, it appears that changes in lifestyle-related behaviors (diet, physical activity) in elementary and middle school students in Abyek city during the COVID-19 quarantine have no impact on their cognitive performance; however, a significant and positive relationship exists between students' physical activity levels and dietary habits, and changing these habits leads to changes in their physical activity levels. Additionally, a significant and positive relationship exists between students' cognitive performance and sleep quality, and changing sleep-related behaviors can improve their cognitive performance. Based on the research results, it can be concluded that changes in lifestyle-related behaviors, including diet, physical activity, and sleep quality, during the COVID-19 quarantine can impact the cognitive performance of elementary and middle school students in Abyek city. Students' sleep quality has a positive relationship with cognitive performance and a positive and negative relationship with physical activity levels. A direct and moderate relationship exists between students' dietary habits and their physical activity levels. Differences were observed in BMI scores, physical activity, and dietary habits among students during the quarantine, with girls having better BMI and dietary habits and boys having better physical activity levels; therefore, modifying lifestyle-related behaviors can help improve students' cognitive performance during the COVID-19 quarantine.

5. Suggestions and Limitations

The main limitation of this study was the lack of physical access to subjects and their parents. Additionally, investigating and correlating parental behavior during and post-quarantine can provide a better analytical perspective on students' behavioral changes, although researchers have collected this information and are in the data analysis stages.

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Declaration of Interest

According to the authors, this article has no financial support and no conflicts of interest.

Authors' Contributions

Both authors made substantial contributions to the research process, covering various aspects from study design to data handling and manuscript preparation.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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