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The Impact of COVID-19 Lockdown Process on Dietary Behaviours and Physical Activity Habits of High School Students

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Abstract

This study aimed to investigate the effects of home confinement as a result of lockdown on physical the activity (physical activity and dietary behaviors), and their determinants, on Turkey high school students (14-18 years). Methods: A total of 490 students (mean age = 16.40 ± 1.75) participated in the study. An online questionnaire consisting of sociodemographic data, nutritional behavior and physical activity habits was applied to the participants. He compared physical activity level (PA), dietary behavior (DB), and sitting time before and during lockdown. Results: BMI (kg/m²) has increased compared to before Covid-19, Physical activity levels of high school students decreased ($p < 0.001$), increased more their sitting time during lockdown (0.041***), eating habits changed (0.310***). Conclusion: Our data show that high school students are affected by isolation and lockdown and exhibit negative behavioral changes.

Keywords: Lockdown, COVID-19, Physical Activity, Eating Habits, High School Population

1. Introduction

1.1 Introduction to the Problem

COVID-19 has spread rapidly all over the world since the beginning of 2020. Since the first case was confirmed, more than 133,883,398 million COVID-19 have been detected worldwide, and more than 2,904,617 people have died (as of April 9, 2021) (Brancaccio et al., 2021). In addition to the mortality rates associated with COVID-19, some negative effects on physical and mental health have been identified, such as increased anxiety, depression, or stress during lockdown (Chambonniere et al., 2021, Demirci et al., 2018). Anybody movement produced by skeletal muscles that cause energy expenditure is defined as physical activity and includes various subgroups

such as walking, cycling or sports. A subset of physical activity aimed at planned, purposeful, repetitive, and fitness gains are typically referred to as "exercise" (Morres et al., 2021). To be physically active, to improve the health of individuals and society, and to contribute to the social, cultural and economic development of all nations, to enable people to perform their daily lives in safer and more convenient environments. Therefore, it is aimed to prevent the increase in inactivity in adults and adolescents by 2030 and achieve a relative decrease of 15% (WHO, 2018). Changing our exercise habits and lifestyle behaviors should be the main goal in order to maintain a certain level of physical activity (PA) and adequate health, and to counteract the negative consequences of certain diseases (Ozemek et al., 2019). Therefore, it is very important to maintain an active lifestyle at home during the outbreak, and not to completely interrupt or change people's lifestyles for the health of the general population, especially those with additional risk factors and the elderly. Regular physical activity is one of the most important activities you can do for your health. For all of us, children, young and old, regular physical activity is synonymous with protecting our health. Most of the time, it is suggested that moderate physical activity strengthens the immune system compared to sitting (Demirci, 2020). During the lockdown period, all primary and secondary schools were completely closed, and all teaching activities were carried out online (Carriedo et al., 2020; Chouchou et al., 2020). As a direct consequence, reduced of physical activity and increased of inactivity have been associated with impaired well-being, mental, physical, and metabolic health. In this process, surveys were conducted in many countries to evaluate the effects of lockdown on inactivity and to reveal the insufficient physical activity (Genin et al., 2020; Werneck et al., 2021).

When cross-sectional and experimental studies on the young were examined, it was seen that they had positive and negative effects on physical activity and inactivity, respectively. According to the data of the World Health Organization; 60 min. moderate (aerobic) and vigorous (anaerobic) intensity physical activity each day of the week, or 150 min. of aerobic activity each day of the week, or an equivalent combination of 75 minutes of anaerobic activity, seizures of 10 minutes are recommended. This highlights the importance of increased physical activity for better health in adolescents. According to some research results conducted among children and adolescents; In a study conducted by Moore et al. (2020) in Canada, 1,472 children aged 5-17 years showed that only 4.8% of children (5-11 years) and 0.6% of youth (12-17 years) had reached the recommendations for a healthy lifestyle (24h movement guidelines) during this lockdown. At the same time, Medrano et al. (2020) obtained similar results in their study with 113 children aged 12, López-Bueno et al., (2020) with 860 Spanish teenagers aged 3-16. However, Gilic et al., (2020) aged 688 Bosnia-Herzegovina youth ages 15-18 and Elnaggar et al., (2020) maize juveniles and Pombo et al. (2020) achieved similar physical activity results in 2,159 Portuguese children aged 13. In fact, the Coronavirus emergency has highlighted how the pandemic has affected the lifestyle of the world's population, which has led to an increase in sedentary life in both childhood and adulthood. Therefore, it has been suggested that the social distance and restrictions applied during the quarantine period upset the habits of the students.

It is suggested that the COVID-19 epidemic, which is effective in all areas of life, is one of the factors that can affect eating behaviors and appetite (Haleem et al., 2020). It is seen that many individual and social factors from childhood to adolescence are effective on nutritional behavior. The lockdown due to the epidemic led to some changes in eating habits, and some studies on humans revealed that it increased unhealthy food consumption, uncontrolled eating, more snacks between meals and generally more main meal consumption (Ammar et al. others, 2020; Güzel et al., 2020). Several studies have revealed changes in many nutritional behaviors, including binge eating habits. Di Renzo et al. (2020) argued that the consumption of homemade products and plates increased with the products that may have been purchased from the grocery store. Similarly, another study by Sidor & Rzymiski (2020) reported that the participant ate more. In addition, Phillipou et al. (2020) suggested that both restrictive and binge eating behaviors increased.

1.2 Objective of the Study

This study aims to evaluate the factors that may affect PA and DB in high school students before and during the lockdown imposed by the COVID-19 outbreak. Within the scope of this main aim, the following research questions were investigated:

- Did the eating habits of high school students change according to gender before and during the epidemic?
- Did physical activity habits of high school students change according to gender before and during COVID-19?
- Is there a significant difference in high school students' physical activity habits before and during lockdown?

2. Method

2.1. Participants and Study Design

After deciding to fill in the questionnaire, information about the study was made to the high school population and participants using online Google Forms and communicated via e-mail and WhatsApp. The surveys obtained from the participants were made ready and attention was paid to the protection of all personal data. Inclusion criteria in the questionnaire used in the research process, high school (only students from randomly selected schools were allowed to be included), age (only students aged 14-18 were allowed to be included), and voluntary participation consent form were completed. After the data obtained from the questionnaires were collected, the forms were verified by making comparisons, and forms containing incorrect or incomplete information or conflicting information were excluded from the study. When making a selection, no distinction was made between the answers (the same answers to all questions using the same scale) and the information was deemed unreliable if it gave uniform responses to all questions considered to be related. Finally, a total of 490 high school students were included in the study. An online questionnaire consisting of socio-demographic data, nutritional behavior and physical activity habits was applied to the students. He compared physical activity level (PA), feeding behavior (DB), and sitting time before and during lockdown. The questionnaire created by the researchers has been applied anonymously to the high school population (students) via an online platform. Respondents were asked to answer the questions of the self-administered online questionnaire (completed in less than 5 minutes), informing them that they could stop compiling at any time without the obligation to justify the decision. The work was carried out in accordance with the Declaration of Helsinki and the current privacy law and the data were processed (EU Regulation 2016/679 and Privacy Code D.Lgs. 101/2018). No formal agreement has been requested with the ethics committee as we are conducting an anonymized survey online.

Socio-demographic data prepared by the authors (age, gender, weight before covid-19, and current of covid-19, height, BMI and evaluate the status of caught with covid-19 disease. In the section on nutritional behavior and physical activity habits; eating habits consumed before and during covid-19, consumption of more food than before quarantine, consumption of fruits and vegetables during quarantine, consumption of more fast food and fast food compared to the pre-quarantine period, eating breakfast, eating without hunger during the day, snack consumption frequency. When investigating physical activities performed before quarantine, the time spent in moderate or vigorous activities on weekdays, pre-quarantine exercise frequency, previous physical activity level compared to the quarantine period, the current exercise frequency during quarantine, and the effect on the time spent sitting during the quarantine process.

2.2. Statistical Analysis

The normality of the data in the study was carried out using the Shapiro-Wilk test. Then, means and standard deviations, percentages and frequencies were calculated according to sociodemographic characteristics. Factors associated with the evolution of the three indicators (PA level, sitting time, and Dietary Behavior) before / during the lockout (increase, similarity, decrease) were studied with Pearson's chi-square test. Univariate comparisons between groups and variables were investigated using Fisher's exact test for categorical data or the nonparametric Wilcoxon rank sum test when appropriate for continuous data. Statistical significance was taken at the level of <0.05 .

3. Results

The comparison of sociodemographic characteristics by gender is presented in Table 1. 43.6% (n = 214) of participants were females with mean age 16.30±1.74 (females) and 56.4% (n = 276) with mean age 17.50±1.76 years (males). We found statistically significant differences based on gender in relation to sociodemographic variables: age, weight before and during covid-19, height, pre-covid-19 BMI and present (<0.01**). In particular, during the quarantine both females and males underwent weight gain. It was determined that there was an increase in the overweight and obese status of the participants during the Covid-19 process (<0.001 ***). In addition, it was found that 34.5% of the participants did not caught Covid-19, 3.8% were covid-19 patients, and 61.7% did not get tested (Table 1).

Table 1: Comparison of high school students' sociodemographic characteristics by gender

	Total n = 490	Female n = 214	Male n = 276	p-Value
Age (years)	16.40± 1.75	16.30±1.74	17.50±1.76	< 0.05*
Weight (kg) before Covid-19	63.3 ±11.0	58.2 ±10.4	68.4 ±11.6	<0.01 **
Current weight (kg)	66.9 ±12.8	61.2 ±12.4	72.6 ±13.2	<0.01 **
Height (cm)	171.4±8.0	167.5 ±6.8	175.4 ±9.2	<0.01 **
BMI (kg/m2) before Covid-19				
<i>Underweight (<18.5)</i>	9 (%1.8)	5 (%2.3)	4 (%1.4)	<0.01 **
<i>Normal (18.5- 24.9)</i>	452 (%92.2)	197 (%92.1)	255 (%92.4)	
<i>Overweight (25-29.9)</i>	19 (%3.9)	8 (%3.7)	11 (%4.0)	
<i>Obese (≥25)</i>	10 (%2.1)	4 (%1.9)	6 (%2.2)	
BMI (kg/m2) current				
<i>Underweight (<18.5)</i>	7 (%1.4)	4 (%1.9)	3 (%1.1)	<0.001***
<i>Normal (18.5- 24.9)</i>	426 (%86.9)	184 (%86.0)	242 (%87.7)	
<i>Overweight (25-29.9)</i>	33 (%6.7)	15 (%7.0)	18 (%6.5)	
<i>Obese (≥25)</i>	24 (%4.9)	11 (%5.1)	13 (%4.7)	
Did you caught Covid-19?				
<i>No</i>	170 (%34.5)	96 (%44.9)	74 (%26.8)	0.360***
<i>Yes</i>	18 (%3.8)	7 (%3.3)	11 (%4.0)	
<i>I did not a test</i>	302 (%61.7)	111(%51.8)	191(%69.2)	

Body Mass Index (BMI),

It was determined that more food was consumed than before covid-19 (0.310 ***), while fruit consumption increased by 18.1% during the quarantine period, 69.9% remained unchanged (0.170 ***). More meals were cooked at home than before the covid-19 (0.317 ***), breakfast habits changed by 87.9% compared to before. Although they did not feel hungry, their eating and snacking behavior increased (0.160 ***) (Table 2).

Table 2. Eating habits before and during the pandemic period of the high school students' by gender.

	Total n = 490	Female n = 214	Male n = 276	p-Value
How was your eating habits before Covid-19?				
<i>2 meals a day</i>	133 (%27.1)	55 (%25.7)	78 (%28.3)	0.260***
<i>3 meals a day</i>	327 (%66.7)	145 (%67.7)	182 (%66.0)	
<i>3 or more meals a day</i>	30 (%6.2)	14 (%6.6)	16 (%5.7)	
How was your eating habits period Covid-19?				
<i>2 meals a day</i>	65 (%13.3)	28 (%13.1)	37 (%13.4)	0.310***
<i>3 meals a day</i>	346 (%70.6)	152 (%71.0)	194 (%70.3)	
<i>3 or more meals a day</i>	79 (%16.1)	34 (%15.9)	45 (%16.3)	

Continuation of Table 2. Eating habits before and during the pandemic period of the high school students' by gender.

	Total n = 490	Female n = 214	Male n = 276	p-Value
<u>Has your fruit consumption changed during the Covid-19?</u>				
<i>Increased</i>	89 (%18.1)	32 (%14.9)	57 (%20.7)	0.170***
<i>Decreased</i>	61 (%12.4)	26 (%12.1)	35 (%12.7)	
<i>Not changed</i>	340 (%69.9)	156 (%73.0)	184 (%66.6)	
<u>How was your food consumption habits compared to the period before Covid-19?</u>				
<i>Normal</i>	101 (%20.6)	43 (%20.1)	58 (%21.0)	0.317***
<i>More home cooking</i>	372 (%75.9)	163 (%76.2)	209 (%75.7)	
<i>More ready meals</i>	17 (%3.5)	8 (%3.7)	9 (%3.3)	
<u>Did your breakfast habits change during the Covid-19?</u>				
<i>Yes</i>	431 (%87.9)	191 (%89.3)	240 (%87.0)	<0.01 **
<i>No</i>	59 (%12.1)	23 (%10.7)	36 (%13.0)	
<u>How often do you eat during the day, even though you are not hungry?</u>				
<i>Every meal</i>	132 (%26.9)	62 (%29.0)	70 (%25.3)	0.415***
<i>1-2 times / A week</i>	43 (%8.8)	17 (%7.9)	26 (%9.4)	
<i>3-4 times / A week</i>	83 (%17.0)	36 (%16.8)	47 (%17.0)	
<i>Sometimes</i>	184 (%37.5)	78 (%36.4)	106 (%38.4)	
<i>Never</i>	48 (%9.8)	21 (%9.8)	27 (%9.9)	
<u>How often are you feeding as an operative in the Covid-19 process?</u>				
<i>Every meal</i>	35 (%7.1)	13 (%6.1)	22 (%8.0)	0.160***
<i>1-2 times / A week</i>	126 (%25.7)	53 (%24.8)	73 (%26.4)	
<i>3-4 times / A week</i>	214 (%43.7)	98 (%45.8)	116 (%42.0)	
<i>Sometimes</i>	92 (%18.8)	41 (%19.2)	51 (%18.5)	
<i>Never</i>	23 (%4.7)	9 (%4.1)	14 (%5.1)	

To investigate the effects of lockdown on physical activity habits, we asked the participants whether their physical activity habits changed during lockdown. As shown in Figure 1, an increase in sedentary behaviors was found in the participants (<0.01 **) (Fig 1).

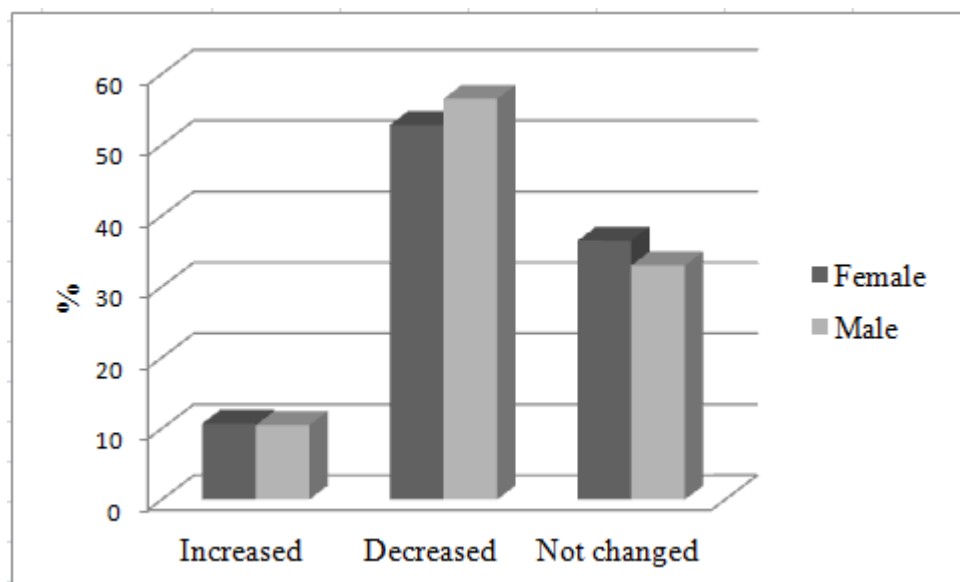


Figure 1: The change in physical activity habits of high school students before and during lockdown

Before Covid-19, the rate of those who did not participate in the activity was 40.6%, while the most attended activity was determined to be 23.5%. Moderate physical activity for a week 43% of women and 30.8% of men <30 min. It was observed that they allocated time under (0.001 ***). While those who did not exercise before Covid-19 were 48%, those who exercised once or twice a week were determined as 24.5%. 3.5% stated that they exercised every day of the week (0.002 ***). On the other hand, the rate of those who spent time sitting in the covid-19 process was 79.8% (0.041 ***) (Table 3).

Table 3: Physical activity habits before and during the COVID-19 period of the high school students' by gender.

	Total n = 490	Female n = 214	Male n = 276	p-Value
<u>What activities did you attend before COVID-19?</u>				
<i>None</i>	199 (40.6)	87 (%40.6)	112 (%40,6)	<0.001 ***
<i>Runing/walk</i>	26 (%5.3)	11 (%5.2)	15 (%5.5)	
<i>Swimming</i>	56 (%11.4)	22 (%10.3)	34 (%12.3)	
<i>Gym</i>	53 (%10.8)	32 (%14.9)	21 (%7.6)	
<i>Team sports</i>	115 (%23.5)	45 (%21.1)	70 (%25.3)	
<i>Other (specify)</i>	41 (%8.4)	17 (%7.9)	24 (%8.7)	
<u>How much time do you spend on aerobic physical activity during a week?</u>				
<i>< 30 min</i>	177 (%36.1)	92 (%43.0)	85 (%30.8)	0.001 ***
<i>30–90 min</i>	135 (%27.5)	57 (%26.6)	78 (%28.3)	
<i>90–150 min</i>	108 (%22.1)	40 (%18.7)	68 (%24.6)	
<i>150–300 min</i>	50 (%10.2)	19 (%8.9)	31 (%11.2)	
<i>> 300 min</i>	20 (%4.1)	6 (%2.8)	14 (%5.1)	
<u>How much time do you spend on anaerobic physical activity during a week?</u>				
<i>< 30 min</i>	235 (%48.0)	105 (%49.1)	130 (%47.1)	0.001 ***
<i>30–90 min</i>	120 (%24.5)	54 (%25.2)	66 (%23.9)	
<i>90–150 min</i>	83 (%16.9)	36 (%16.8)	47 (%17.0)	
<i>150–300 min</i>	35 (%7.1)	14 (%6.6)	21 (%7.6)	
<i>> 300 min</i>	17 (%3.5)	5 (%2.3)	12 (%4.4)	
<u>How much did your exercise frequency before the Covid-19?</u>				
<i>None</i>	235 (%48.0)	83 (%49.1)	96 (%47.1)	0.002 ***
<i>1 or 2 times a week</i>	120 (%24.5)	74 (%25.2)	85 (%23.9)	
<i>3 times a week</i>	83 (%16.9)	41 (%16.8)	69 (%17.0)	
<i>4 or 5 times a week</i>	35 (%7.1)	13 (%6.6)	19 (%7.6)	
<i>Everyday a week</i>	17 (%3.5)	3 (%2.3)	7 (%4.4)	
<u>Has there been any change in your physical activity level process the Covid-19?</u>				
<i>Increased</i>	52 (%10.6)	23 (%10.7)	29 (%10.5)	<0.01 **
<i>Decreased</i>	269 (%54.9)	113 (%52.8)	156 (%56.5)	
<i>Not changed</i>	169 (%34.5)	78 (%36.5)	91 (%33.0)	
<u>Did the Covid-19 process affect the time you spent sitting?</u>				
<i>No</i>	62 (%12.6)	28 (%13.1)	34 (%12.3)	0.041 ***
<i>I spend less time sitting</i>	37 (%7.6)	16 (%7.4)	21 (%7.6)	
<i>I spend more time sitting</i>	391 (%79.8)	170 (%79.5)	221 (%80.1)	

4. Discussion

The COVID-19 outbreak has led to the lockdown of the population around the world, especially students. Numerous scientific studies have been conducted to evaluate the effect on individual movement behavior during

and after this lockdown. As a result, it explained the overall decrease in PA and DB levels. This study aims to determine the impact of lockdown on physical activity, inactivity and eating behavior among high school students, while classes are given online and their physical activities are interrupted. In line with national and international statistics (Farooq et al., 2018), the majority of high school students in our sample were defined as inactive before lock-in (40.6% of women and men). Given the strong links between the health of physical activity and healthy movement behavior (Tremblay et al., 2011), the situation in students before social and physical restrictions was already alarming. According to our results; 52.8% of women and 56.5% of men reported a decrease in PA during lockdown. These results are consistent with those observed in other countries such as Spain (López-Bueno et al., 2020), Bosnia and Herzegovina (Gilic et al., 2020), Egypt (Elnaggar et al., 2020), Canada (Moore et al., 2020), or French children and adolescents (Chambonniere et al., 2021) among others. As a result, the outbreak-related measures, including movement restrictions, were more rigorous. Tighter lockdown measures resulted in more action among people, which resulted in the minimization of time spent outside of homes, resulting in a larger drop in PA and DB for high school students.

The Covid-19 outbreak is often an unpleasant experience for those who suffer from lockdown. Because social distancing, closing schools, banning group meetings, and restricting physical activities suddenly turned the traditional lifestyle upside down (Scudiero et al., 2021). Our study for the first time analyzed basic aspects of high school students' daily life, such as physical activity and eating habits. In our study, we found significant differences in participants' age, weight, height, and BMI before and during covid-19. Both women and men gained weight, especially during the quarantine. In the Covid-19 process, it was determined that the participants were overweight and obese. In addition, it was determined that during the quarantine period, more food was consumed compared to before covid-19, and fruit consumption remained largely unchanged. More meals were cooked at home due to covid-19, breakfast habits changed by 87.9% compared to the previous one. While high school students suffer significantly from quarantine and the deprivation it causes, we can demonstrate that their discomfort in weight gain is accompanied by fessfoot-type food intake. Although they did not feel hungry, their eating and snacking behavior increased. Healthy eating emerged as a secondary important determinant of better well-being. Indeed, it has been suggested that in the COVID-19 outbreak, healthy eating is linked to improved well-being components such as lower depressive and anxious symptoms (Chi et al., 2020). However, eating behavior patterns worsened in the COVID-19 outbreak (e.g. number of main meals or snacks between meals, uncontrolled eating or type of food) (Ammar et al., 2020). Therefore, initiatives towards healthy eating behavior are very important, but potentially challenging due to the poor well-being of high school students. However, the many benefits of physical activity reveal promising perspectives for a healthier diet. In particular, physical activity reduces inactivity and sleep disturbance, which is linked to less impaired eating behavior (Ruiz-Roso et al., 2020).

According to our results; this severe global decline in PA affected high school students during the lockdown period. Before Covid-19, the rate of those who did not participate in the activity was 40.6%, while the most attended activity was determined to be 23.5%. Moderate physical activity for a week 43% of women and 30.8% of men <30 min It was observed that they allocated time under. While those who did not exercise before Covid-19 were 48%, those who exercised once or twice a week were determined as 24.5%. On the other hand, the rate of those who spent time sitting in the covid-19 process was 79.8%. In our study, unlike physical activity and healthy eating behavior, sedentary time predicted a worsening of well-being in high school students. Moreover, students living in COVID-19 lockdowns exhibited increased inactivity and lower well-being (Margaritis et al., 2020; Bates et al., 2020); in particular, the sitting time increased dramatically Ammar et al., 2020). During the COVID-19 outbreak, tackling sedentary time and related deadlocks should be prioritized to reduce sitting time methods among high school youth. Towards this direction, it is important to consider the potential harmful effects of online education on physical activity and emphasize the importance of physically active breaks in the daily schedule. WHO (2018) guidelines recommend that adolescents (5-17 years) do 60 minutes / day (420 minutes / week) of physical activity for better mental health. Physical activity of participants in this study was well below what WHO levels recommend. The beneficial health effects of physical activity during the COVID-19 pandemic have also been demonstrated in young Chinese who report that more than 60 minutes of physical activity per week is associated with a lower risk of well-being (Qin et al., 2021). Finally, we shed light on exercise and physical activity habits. First, we highlighted an increase in sedentary lifestyle by analyzing the

high school student population (Figure 1); Most likely, this increase comes with spending much more hours on lockdown and online training online.

Conclusions; In the high school student population, the administration of this survey showed how the lockdown measures implemented during the COVID-19 pandemic affected their usual lifestyle. Changes in students' lifestyle (including physical activity and eating habits); It caused weight gain, increased sedentary lifestyle, inconsistent eating behavior, lack of physical activity, and an increase in fessot type nutrition. Therefore, it can be argued that it has negative effects on the physical and psychological health of all students. Therefore, this study can be a reference for the functional studies that will be needed when such lockdown measures are completely eliminated.

4.1. Limitations

There are some limitations to this study. Because it is a cross-sectional design, it does not provide any information about the structure and the established relationships can be difficult to interpret. In addition, self-reported data are open to bias information. Finally, the use of unverified questionnaires raises the problem of generalizing the results.

4.2. Author Contributions

Conceptualization; N.D., P.D.; methodology; N.D., H.K., P.D.; investigation; N.D., H.K.; data collecting; H.K., N.D., P.D.; writing original draft; N.D., P.D.; review and editing; N.D., P.D., H.K., contributed to the review of the article. All authors have read and agreed to the published version of the manuscript.

4.3. Conflicts of Interest

The authors declare no conflict of interest.

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