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The impact of social life restrictions during the COVID-19 pandemic process on lipid profile

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Abstract

Because of restrictions and limitations during the COVID-19 pandemic, the majority of individuals had sedentary lives. In this study, we wanted to investigate the impact of sedentary lifestyle on the lipid profiles of adults during the COVID-19 pandemic. All patients whose cholesterol profile was evaluated between 01.03.2019 and 31.12.2021 were gathered from electronic patient records for this retrospective research. According to the dates of their admission to the outpatient clinics, the records of the patients aged 18 to 65 years were separated into three categories: pre-pandemic (March 2019–March 2020), restriction (March 2020–June 2020), and post-restriction (June 2020 –Post) periods. All patients accepted and enrolled in the trial had complete data. Over the course of the three examinations, the cholesterol panels of 376 study participants were analyzed. In the pandemic period higher total cholesterol levels, total cholesterol/high density lipoprotein cholesterol (HDL-C) ratio, and very low-density lipoprotein cholesterol (VLDL-C), results were observed than the pre-pandemic period. The LDL-C levels increased compared to pre-pandemic levels, and were higher during the pandemic than in the post-pandemic normalization period. Restrictions on social activities during the epidemic had a deleterious impact on lipid profiles by encouraging sedentary behavior. Although the process of normalization after the pandemic improved, the pandemic was unable to return cholesterol levels to their pre-pandemic levels.

Keywords: sedentary behavior, hyperlipidemias, pandemics, COVID-19, physical inactivity

1. Introduction

The World Health Organization (WHO) classified the coronavirus disease of 2019 (COVID-19) as a pandemic on March 11th, 2020. Regarding non-pharmacological treatments, the WHO suggested various preventative actions such as avoiding physical contact, closing universities, forbidding social gatherings and huge crowds, isolating, maintaining a social distance, and quarantining (1).

In both industrialized and developing nations, cardiovascular disease (CVD) continues to be the main cause of mortality and morbidity. Male gender, hypertension, diabetes, advanced age, and hyperlipidemia (raised plasma triglyceride and low-density lipoprotein (LDL) levels) are the best-known risk factors for the development of CVD. The lipid profile typically includes total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides. The ratios of these values are crucial for determining cardiovascular risk. For instance, a high LDL/HDL ratio is linked to increased heart disease risk, while a low triglyceride/HDL ratio indicates better cardiovascular health. Thus, the lipid profile and its ratios are essential tools for evaluating overall health. Physical exercise and hyperlipidemia, a modifiable risk factor, have a well-established association (2).

It was found that physical activity reduced, body mass weight increased, and lipid profiles got worse in a small number of studies comparing the COVID-19 pandemic period with the pre-pandemic period (3). However, the literature research revealed that there wasn't a study on this topic in Türkiye. This study was done to demonstrate how the COVID-19 pandemic's effects on sedentary lifestyle had an impact on lipid profiles.

2. Materials and methods

People (18–65 years old) who applied to the Family Medicine Polyclinic, Sıhhıye Medicosocial Health Center, or Hacettepe University Faculty of Medicine between March 1st, 2019, and December 31st, 2021 were included in this retrospective study. Retrospective data from electronic patient records were collected for the lipid panel. Pre-pandemic (March 2019–March 2020), restriction period (March 2020–June 2021), and post-restriction period (June 2021–post) data were gathered separately. The study included all individuals who underwent examinations and had no missing data (Fig.1).

Fig. 1. Sample Date Period Intervals of the Study

There are 44794 applications to our Beytepe polyclinics within the indicated periods, and 18802 of them are solitary. There are 26999 applications to our Sıhhiye outpatient clinics

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throughout that time and 9869 of them are solitary. 8990 patients, have have had their cholesterol panels evaluated as a result of these applications. 920 of the 8990 patients had complete data, and the remaining patients were removed from the study. The study comprised a total of 376 participants whose cholesterol panels were tested over the course of the three time periods. The study covered every person between the ages of 18 and 65 who had no missing data (Fig. 2).

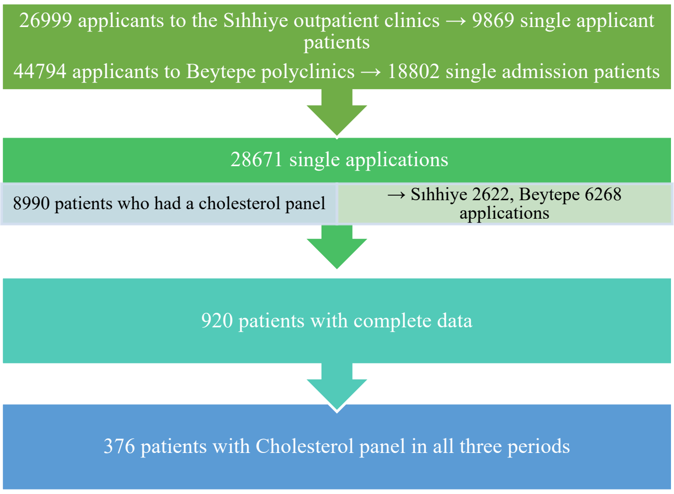

Fig. 2. The Flow Chart of Patient Selection Process

The laboratory's quantitative analysis results are validated internally using quality control guidelines based on Wesgart criteria. The enzymatic calorimetric test (Roche Diagnostics GmbH, Mannheim, Germany) was used to measure triglycerides, total cholesterol, and HDL cholesterol. Using the Friedewald formula, LDL cholesterol was measured.

Frequency tables were used for quantitative data, whereas mean and standard deviation were utilized for continuous variables. The association between the data was investigated using the chi-square test. The t test, the ANOVA test, or their nonparametric equivalents were used to compare differences between continuous variables. The significance level was set equal to a=0.05. With the IBM SPSS 24.0 package application (IBM Corp., released 2016), statistical analyses were carried out.

3. Results

Of the participants in our study, 49.7% (n=187) were male and 50.3% (189) were female; and the mean age was 49.81±9.069(min:30, max:64) years. Chronic disease was present in 26.1% (n=98) of the patients in the study, and 73.9% (n=278) did not have any chronic disease. Chronic diseases ratios were; 1.9% (n=7) had Diabetes Mellitus, 2.9% (n=11) had thyroid diseases, 2.4% (n=9) had hypercholesterolemia, 16.5% (n=62) had cardiovascular disease and 7.2% (n=27) had other chronic diseases.

The mean total cholesterol of the patients included in the study in the pre-pandemic period was 260.21±70.296 mg/dl (min=135, max=376), the mean total-cholesterol/HDL ratio was 5.33±1.94 (min=1.90, max=12.06), HDL mean was 51.61±12.14 mg/dl (min=31, max=73), LDL mean was 155.40±30.89 mg/dl (min=107, max=209). The mean total cholesterol of the patients during the pandemic was 276.35±71.15 mg/dl (min=136, max=398), the mean of total-cholesterol/ HDL ratio was 6.03±2.13 (min=2.03, max=13.17), the mean of HDL. It was 48.56±11.76 mg/dl (min=29, max=68), LDL mean was 184.35±33.77 mg/dl (min=126, max=241). The mean total cholesterol of the patients in the post-pandemic period was 276.54±68.16 mg/dl (min=135, max=398), the mean total-C/HDL ratio was 6.01±2.19 (min=2.45, max=13.10), HDL the mean was 48.79±11.59 mg/dl (min=29, max=72), and the mean LDL was 174.77±3456 mg/dl (min=114, max=233) (Table 2).

The total cholesterol values were considerably higher than pre-pandemic values throughout the pandemic and post-pandemic periods (p=0.014) when comparing the patients' cholesterol panels from the pre-pandemic, pandemic, and post-pandemic periods.

In comparison to the pre-pandemic period, the total cholesterol/HDL ratio was significantly greater during the pandemic and post-pandemic periods (p=0.033).

• The pre-pandemic period's HDL value was significantly greater than it was during the pandemic and post-pandemic periods (p 0.001).

• The pandemic period's LDL value was substantially greater than its post-pandemic and pre-pandemic counterparts (p 0.001).

• The post-pandemic phase had significantly higher VLDL and non-HDL readings than the pre-pandemic and pre-pandemic periods (p 0.001).

• The triglyceride value (0.012) was much greater during the pandemic than it was before and after. (Table 1).

Total cholesterol value: It increased (p=0.004) from the pre-pandemic period to the pandemic period. The post-pandemic period saw a higher level of it than the pre-pandemic period (p=0.003). Total cholesterol/HDL-C ratio: It was significantly greater during the pandemic than it was before (p 0.001). When compared to before the pandemic, it increased (p 0.001) in the post-pandemic period. When compared to before the pandemic, the HDL-C value was lower during the pandemic period (p=0.001). When compared to before the pandemic, it was lower in the post-pandemic period (p=0.001).

LDL-C value: It was significantly greater during the pandemic than it was before (p=0.001). When compared to before the pandemic, it increased (p=0.001) in the post-pandemic period. When compared to the post-pandemic period, it was higher during the pandemic period (p=0.001).

VLDL-C value: It was much greater during the pandemic than it was before (p=0.001). When compared to before the pandemic, it increased (p=0.001) in the post-pandemic period.

Table 1. Comparison of the patients' cholesterol pandemic before, during, and after the pandemic period

	Number (n)	Percentage (%)
Gender		
Male	187	49.7
Female	189	50.3
Chronic Disease	98	26.1
DM	7	1.9
Thyroid Diseases	11	2.9
Hypercholesterolemia	9	2.4
CVD	62	16.5
Other Chronic Disease	27	7.2
Distribution of Chronic Disease in men		
Chronic Disease	51	27.1
DM	5	2.7
Thyroid Diseases	1	0.5
Hypercholesterolemia	4	2.1
CVD	37	19.8
Other Chronic Disease	14	7.5
Distribution of Chronic Disease in women		
Chronic Disease	47	24.9
DM	2	1.1
Thyroid Diseases	10	5.3
Hypercholesterolemia	5	2.6
CVD	25	13.2
Other Chronic Disease	13	69

When compared to the pre-pandemic period, the NON-HDL-C value was lower during the pandemic period (p=0.027). Compared to the pandemic period, it was higher in the post-pandemic phase (p=0.01).

Triglyceride values: They were much greater during the pandemic than they were before (p=0.001). In comparison to the pandemic period, it was lower in the post-pandemic phase (p=0.001). (Table 2).

Table 2. Patients' lipid profiles throughout the pandemic/pre-pandemic, pandemic/post-pandemic, and post-pandemic/pandemic periods were compared pairwise

	Before the pandemic	During pandemic	After pandemic	
	Mean/ SD	Mean/ SD	Mean/ SD	p
Total Cholesterol	260.21±70.29	276.35±71.15	276.54±68.16	**0.014**
Total-C /HDL-C Ratio	5.33±1.94	6.03±2.13	6.01±2.19	**0.033**
HDL-C	51.61±12.14	48.56±11.76	48.79±11.59	**<0.001**
LDL-C	155.40±30.89	184.35±33.77	174.77±34.56	**<0.001**
VLDL-C	27.60±10.74	34.38±12.22	35.87±13.80	**<0.001**
Non-HDL-C	144.47±36.49	138.10±35.35	147.93±38.77	**<0.001**
Triglyceride	167.56±65.73	190.03±68.69	169.98±62.09	**0.012**

4. Discussion

Since March 11th, 2020, the SARS CoV-2 outbreak has been classified as a COVID-19 pandemic by the WHO. Countries had to create isolation methods to restrict contact, including remaining at home, in order to stop the virus from spreading. Along with staying in, physical activity levels and duration reduced, and sedentary behavior was more likely to occur (4). If left untreated, hyperlipidemia can worsen prognosis and is a significant risk factor for cardiovascular disorders (5).

Pre-pandemic, pandemic period, and post-pandemic periods were used to evaluate and compare the cholesterol panels of the participants. The pandemic process levels were found to be significantly higher than the normalization process when the restrictions were partially removed. When we examined the patient profile used in the study, we found that the percentages of female (50.3%) and male (49.7 %) patients is equal.

When cholesterol levels were considered, there was a difference between the pre- and post-pandemic periods in our study, but curiously, there was no discernible difference between the pandemic and post-pandemic periods. An increase in total cholesterol levels was seen compared to the pre-pandemic phase in longitudinal research looking at the effects of COVID-19 limitations on nonalcoholic steatohepatitis and insulin resistance in individuals in the pre-pandemic and post-pandemic periods by López-González et al. (6).

While HDL-C levels were high in the pre-pandemic era of our study we discovered that the levels during the pandemic and post-pandemic normalization processes were much lower. Similar to total cholesterol levels, there is no significant difference between HDL-C values during the pandemic and afterward, and they are also comparable.

Metabolic indicators from a retrospective cohort study of Chinese workers were assessed in 2018, 2019, and 2020. Except for fasting blood glucose, all metabolic indicators (higher TG level, lower HDL-C level, increased abdominal fat, and elevated systolic blood pressure) were determined to be considerably worse than before quarantine (7).

Increased TG/HDL-C ratio, or high triglyceride levels coupled with low HDL cholesterol levels, was found to be strongly correlated with the presence of tiny, dense LDL particles in plasma. Numerous investigations have revealed the TG/HDL-C ratio to be a potent biochemical indicator of ischemic heart disorders (8). In our study the total cholesterol /HDL ratio was discovered to be considerably lower in the pre-pandemic period compared to the pandemic and post-pandemic periods, similar to triglyceride ratios.

Because there is a considerable body of evidence that supports the link between the blood concentration of this molecule and the risk of CVD (9), LDL-C, the main circulating Apo B-containing lipoprotein, represents the primary target of the majority of currently available lipid-lowering treatments. In our investigation, significant differences were identified between the pre-pandemic and the pandemic period, the pandemic period and the post-pandemic era, and the pre-pandemic and post-pandemic period when we compared the LDL-C values of the patients in pairs. The epidemic period witnessed the highest values. Although LDL-C values declined after the pandemic, they were unable to return to the low levels seen before the outbreak. In order to determine how COVID-19 isolation affects anthropometric factors, blood pressure, glucose levels, and lipid profiles in healthy persons, Ramrez Manent et al. conducted a longitudinal study. This study, which included 6236 workers between the ages of 18 and 69 years who were in good health, engaged in their jobs, and took part in routine workplace health inspections revealed a statistically significant rise in LDL levels (10).

The primary TG carrier in human serum and a precursor to LDL is VLDL, a lipoprotein released by the liver (11). In our study, VLDL values were higher in hr the pandemic and post-pandemic periods than the pre-pandemic period.

The level of non-HDL cholesterol, which raises the risk of cardiovascular disease, rises while HDL levels, the protective cholesterol, decreases (12). According to our research, non-HDL-C levels were similar between the pre- and post-pandemic periods but decreased during the pandemic.

Triglyceride levels, one of the cardiometabolic risk markers, significantly increased after quarantine, according to Woo et al.'s longitudinal study on overweight or obese children and adolescents' sedentary time and fast-food consumption associated with weight gain during COVID-19 quarantine (13). Our results were similar to those of this study and were much higher during the pandemic period with quarantine and limitations than they were during the pre-pandemic and post-pandemic periods, but the post-pandemic and pre-pandemic periods were also shown to be comparable.

Smoking, alcohol consumption, obesity, physical inactivity, sedentary lifestyle, hypertension, diabetes, and dyslipidemia are a few of the modifiable risk factors for CVD (14). Long-term physical exercise enhances markers of CVD risk and directly lowers CVD risk in healthy adults, according to a meta-analysis (15). Public health is now at risk due to the COVID-19 pandemic's rapid spread and severity. More than a third of the world's population were under some type of quarantine till April 2020 as a result of measures like lockdowns or isolation. The population's physical and mental health suffered as a result of the quarantine, which also caused a substantial change in food habits and a decline in physical activity.

Boredom has resulted in overeating or appetite loss as a result of lifestyle changes and absences from job, school, or other activities. A drop in the consumption of fish, seafood, fruits, and vegetables was accompanied by an increase in the consumption of salty and sweet snacks. Unbalanced eating habits have also been linked to abnormalities of physical activity and increased sleep length in adults and adolescents. As a result, the global population gained more weight during the quarantine period—from 11.1% to 72.4%. The likelihood of developing metabolic problems will rise as a result (10).

Significant variations are already expected in our study's analysis of the cholesterol panel results between the pre-pandemic period and the pandemic process because of the quarantine measures used during the pandemic process. The values we saw during the post-pandemic normalization process were identical to those observed throughout the pandemic process, though. We believe that sedentary behavior has become a habit despite the limitations being lifted following the epidemic due to the ongoing transformation. Maruo et al. evaluated lifestyle changes six months before and six months after the COVID-19 pandemic in a single-center observational study that looked at how the pandemic affected diabetic patients. They demonstrated that compared to the pre-pandemic period, physical activity dramatically decreased during the post-pandemic phase, whereas sedentary behavior greatly increased (15). It appears that COVID-19 fatalities will continue to raise the risk of CVD because of these sedentary habits, rather than just being tied to the pandemic or the illness.

Our study does have certain limitations. The number of patients in our study was low because it was limited to the outpatient clinics at the - University Faculty of Medicine, Department of Family Medicine, and - University Medicosocial Unit. At the beginning of the pandemic process, our outpatient clinic applications were reduced because a wave of panic and fear spread in the society. At the same time chronic disease follow-ups decreased. Because those with chronic diseases had been restricted from going out due to government policies. In addition, since our polyclinics are located on the campus, there was no patient approach based on the registered population like other family medicine centers, and the patient population was generally composed of hospital staff and students. This caused our patients to be variable and reduced our possibility of seeing patients constantly A further limitation of the study is that the patients' drugs that treat their lipid profile were not reached. A significant proportion of patients stopped taking their regular prescriptions as a result of pandemic restrictions as well as the challenges associated with applying to elective outpatient clinics. This is a significant contributing component to the patients' lipid profile worsening. As such, it is challenging to fully ascribe all of the study's findings to a sedentary lifestyle. In addition, the fact that the study was conducted as a retrospective file scan creates a limitation in terms of the reliability of the diagnoses.

Our study has some superior aspects compared to other studies on this subject in the literature. There is no literature study comparing cholesterol levels in all three periods (pre-pandemic, pandemic process and post-pandemic normalization period). Our patient group did not include the geriatric population allowed less variables that could affect cholesterol values due to the low rate of chronic diseases.

The post-restriction phase shows the continuation of the habits formed during the pandemic.

Measures taken during the pandemic; considering that the habits formed during this time continue afterward, changes might be made to eating and physical activity routines. Studies to boost physical activity should be conducted for unusual circumstances like the COVID-19 pandemic.

Ethical Statement

The Hacettepe University Non-Invasive Clinical Research Ethics Committee granted ethical permission prior to the study's launch with a decision dated 07.12.21, project number GO21/1297, and decision number 2022/14-60.

Conflict of interest

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript.

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Authors' contributions

Concept: S.A., İ.F., Design: S.A., İ.F., Data Collection or Processing: S.A., İ.F., Analysis or Interpretation: S.A., D.A.B., H.A., Literature Search: S.A., İ.F., H.A., Writing: S.A.

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