

Assessment of Serum Lipid Profile among Sudanese Patients with COVID-19

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Abstract

Background: COVID-19 pandemic has been linked to dyslipidemia in patients.

Objective: To investigate the alterations in serum low-density lipoprotein (LDL)-cholesterol, high-density lipoprotein (HDL)-cholesterol, very low-density lipoprotein (VLDL), total cholesterol (TC), and triglycerides (TG) levels in individuals with COVID-19 infection.

Cases and Methods: This study was conducted at Jabra Hospital, Khartoum state, Sudan, from February to September 2021. It was an analytical, controlled hospital-based study that involved a total of 136 subjects. Of these, 68 were Sudanese patients who had contracted COVID-19, while the other 68 were healthy individuals who served as the control group. Data was collected through a questionnaire, and the serum lipid profile was estimated using spectrophotometric methods through an enzymatic process. The data was analyzed using SPSS (V25).

Results: The study found that patients with COVID-19 had significantly lower levels of serum LDL, VLDL, TC, and TG compared to the control group. The *p-values* for these differences were 0.001, 0.002, 0.000, and 0.001, respectively. There was no significant difference in serum HDL and BMI between the two groups. In the case group, serum lipid profiles (excluding HDL) were significantly higher in overweight individuals compared to those with normal weight. The *p-values* for these differences were 0.001, 0.002, 0.001, 0.001, 0.001, respectively. However, there was no significant difference in serum HDL levels between the two weight groups. Interestingly, the serum lipid profile was significantly higher in overweight controls compared to the cases. The *p-values* for these differences were 0.001, 0.041, 0.024, 0.001, and 0.001, respectively. Lastly, the study found that the serum lipid profile was significantly lower among severe COVID-19 patients compared to the control group with a *p-value* of ≤ 0.001 . Specially, serum LDL and TC were significantly lower in patients than controls, with *p-values* of ≤ 0.001 and 0.003, respectively. On the other hand, serum TG was significantly higher in cases than controls with a *p-value* of ≤ 0.001 . Serum VLDL and HDL levels were not significantly different between the two groups.

Conclusion: Research has suggested that individuals who have contracted COVID-19 have shown a decrease in lipid profile values compared to those who have not been affected by the virus.

Keywords: Serum lipid profile, COVID-19, Sudanese, LDL, TG, BMI.

Introduction:

Coronaviruses are serious diseases in both humans and animals. An outbreak of pneumonia cases in Wuhan, a city in China's Hubei Province, was traced to a new coronavirus at the end of 2019. It quickly spread, causing an epidemic in China and a pandemic that affected the entire world. The World Health Organization classified the illness COVID-19, short for coronavirus disease 2019, in February 2020 (1). In the past, known as 2019-nCoV, the virus that causes COVID-19 was known as severe acute respiratory

syndrome coronavirus 2 (SARS-CoV-2). Emerging coronaviruses have become a new public health concern in the 21st century due to the emergence of two highly pathogenic coronaviruses with zoonotic origins, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), in humans in 2002 and 2012, respectively (2). This new coronavirus illness, also known as COVID-19 or coronavirus disease 2019, is extremely contagious and has spread quickly worldwide (3). In terms of the number of sick individuals and the geographic scope of the epidemic

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locations, it has decisively surpassed SARS and MERS.

The ongoing COVID-19 outbreak has seriously threatened worldwide public health (4). Human lipids, which include cholesterol, triglycerides, and fatty acids, are thought to be crucial for the health of the human body because they form the building blocks of cell membranes, serve as precursors to steroid hormones, and influence the fluidity of cell membranes and the activation of enzymes found there. TG is made up of three fatty acids bonded to a glycerol molecule. Regarding lipoproteins, it is stressed that these enable the solubilization and movement of lipids, which are typically hydrophobic materials in plasma. There are four main classes of lipoproteins, which are divided into two categories: Those that are TG-rich, represented by chylomicrons of intestinal origin, and VLDL, those that are rich in cholesterol and form LDL and HDL (5).

In many cases, the quantities of these lipids and/or lipoproteins in the human body are unusual, a condition recognized as dyslipidemia (6). FCholesterol is crucial for SARS-CoV-2 to infect host cells (7). In an in-vitro investigation, membrane-bound cholesterol in ACE2-expressing cells lowered the SARS-ability CoVs to infect cells by 50%, reducing the spike protein's ability to bind (8).

Additionally, it has been suggested that cholesterol may boost SARS-affinity CoV-2's for ACE2 and thus its contagiousness by altering the S spike shape of this coronavirus (9). It has also been proposed that the scavenger receptor, class B type 1 (SR-B1), plays a significant role in the entry of SARS-CoV-2 into the host cell. In experiments, it was discovered that using the SR-B1 antagonist decreased SARS infectiousness (10).

This study aimed to evaluate the serum lipid profile in Sudanese patients with COVID-19 infection.

Cases and Methods

An analytical case-control hospital-based study was conducted in Jabra Hospital, Khartoum state, Sudan, during the period from February to September 2021. A total of 136 subjects were included in this study: 68 Sudanese patients with COVID-19 as the case group and 68 apparently healthy subjects as the control group.

Inclusion criteria: Sudanese individuals who were healthy during the study from Khartoum town were selected as controls in both age, gender, and BMI, and positive COVID-19 patients were selected as cases, grouped according to their symptoms into mild (non-hospitalized / home care) or severe (hospitalized).

Exclusion criteria: Individuals not meeting the inclusion criteria or with underlying diseases that may affect serum lipid levels were excluded from this study.

Data collection: Data was collected from the respondents using a questionnaire form and laboratory test results for lipids. Enzymatic spectrophotometric methods estimated the lipid profile.

Data analysis: Data was analyzed by using SPSS version (25), presented as (mean±SD) with P value ≤ 0.05 considered significant.

Quality controls: The standards and measurements of quality control of all materials and reagents used were done according to standardized quality control measures.

Ethical considerations: The participants were informed that their information was highly secured and would not be used for purposes other than scientific inquiry. Consent was obtained from all studied individuals before starting data collection. Ethical clearance was obtained from Alzaeim Alazhary University.

Results

Of the 68 COVID-19 cases, 33 were males, and 35 were females, with a mean age of (54 ± 4.7 years), while of the 68 controls, 32 were males and 36 were females, with a mean age of (48 ± 3.5 years). Most of the COVID-19 patients were elderly. The mean age was 53.2 years in obese cases compared to 45.3 years among the control. The mean age of the non-obese cases was 55.7 years compared to 40.4 years in the control group was. Thirty four patients (50%) of the COVID-19 cases were overweight.

Table 1 shows that serum LDL, VLDL, TC, and TG were significantly lower in cases than in controls (*p-value* ≤ 0.001, 0.002, 0.000, and 0.001), respectively. Serum HDL and BMI were non-significantly different between cases and controls.

Table 2 shows the (mean ±SD) of LDL, HDL, VLDL, TC, TG, and BMI in overweight and normal-weight Covid-19 cases. Serum lipid profile indicators apart from HDL were significantly higher in overweight than normal weight cases (*p-value* ≤ 0.001, 0.002, 0.001, 0.001, 0.001), respectively. Serum HDL was non-significantly higher in overweight than normal-weight COVID-19 cases.

Table 3 shows that the (mean ±SD) of LDL, HDL, VLDL, TC, and TG of overweight individuals were significantly higher in overweight controls than in cases (*p-value* ≤ 0.001, 0.041, 0.024, 0.001, 0.001) respectively. The BMI in the two groups was the same.

Table 4 shows that the (mean ±SD) of LDL, HDL, VLDL, TC, and TG among mild COVID-19 cases were significantly lower than in controls (*p-value* ≤ 0.001, 0.002, 0.001, 0.001 respectively), while serum HDL was non-significantly lower. The (mean ±SD) of LDL, HDL, VLDL, TC, and TG among severe COVID-19 cases were significantly lower than controls (*p value*=0.001).

Table (1): Mean \pm SD of serum lipid profiles in COVID-19 patients and controls

Parameter	Cases (No.= 68)	Controls (No.= 68)	P-value
LDL (mg/dl)	65 \pm 4.3	83 \pm 3.7	0.001*
HDL (mg/dl)	52 \pm 2.4	50 \pm 1.8	0.062
VLDL (mg/dl)	26 \pm 1.3	33 \pm 2.2	0.002*
TC (mg/dl)	144 \pm 5.7	165 \pm 6.2	0.000*
TG (mg/dl)	138 \pm 3.7	160 \pm 4.4	0.001*
BMI (Kg\m ²)	24.4 \pm 3.1	24.7 \pm 2.6	0.435

Table (2): Mean \pm SD lipid profile in overweight and normal-weight COVID-19 cases

Parameter	Overweight (No.= 34 individuals)	Normal weight (No.= 34 individuals)	P-value
LDL (mg/dl)	56 \pm 2.2	53 \pm 1.7	0.001*
HDL (mg/dl)	53 \pm 1.9	43 \pm 1.2	0.241
VLDL (mg/dl)	28 \pm 1.5	23 \pm 1.2	0.002*
TC (mg/dl)	133 \pm 5.2	119 \pm 3.8	0.001*
TG (mg/dl)	139 \pm 5.7	116 \pm 3.3	0.001*
BMI (Kg\m ²)	26.6 \pm 1.2	21.6 \pm 1.2	0.001*

Table (3): Mean \pm SD lipid profile in overweight in cases and controls

Parameter	Overweight Covid cases (No.= 34 individuals)	Overweight Controls (No.=34 individuals)	P-value
LDL (mg/dl)	56 \pm 2.2	78 \pm 5.3	0.001*
HDL (mg/dl)	53 \pm 1.9	54 \pm 2.8	0.041*
VLDL (mg/dl)	28 \pm 1.5	37 \pm 2.2	0.024
TC (mg/dl)	133 \pm 5.2	168 \pm 8.1	0.001*
TG (mg/dl)	139 \pm 5.7	177 \pm 7.3	0.001*
BMI (Kg\m ²)	26.6 \pm 1.2	26.7 \pm 1.1	0.721

Table (4): Mean \pm SD lipid profile among mild and severe COVID-19 cases

Test (mg/dl)	Controls (No.= 68)	Mild Covid-19 (No.= 34)	P-value (Mild and controls)	Severe Covid-19 (No.= 34)	P-value (Severe and controls)
LDL	78 \pm 4.2	60 \pm 3.2	0.001*	53 \pm 2.4	0.001*
HDL	54 \pm 2.3	53 \pm 1.8	0.241	43 \pm 1.4	0.001*
VLDL	37 \pm 3.4	32 \pm 3.1	0.002*	23 \pm 2.7	0.001*
TC	168 \pm 6.4	145 \pm 5.6	0.001*	119 \pm 4.2	0.001*
TG	177 \pm 6.8	162 \pm 5.8	0.001*	116 \pm 3.9	0.001*

Discussion

The observation was most patients were elderly due to infected patients of younger ages having very powerful immune systems and 'don't attend hospital but stay at home' (11). The results showed significant differences in lipid profile in COVID-19 patients, with a significant decrease in serum LDL, VLDL, TC, and TG compared to the control group. Serum HDL was not different between COVID-19 and healthy people. The lower values of the lipids among the Covid cases may be a consequence of cytokine storm action as an immune response inhibiting some lipid metabolism pathways. Another cause may be the consumption of lipids by viruses during the virus replication period (12, 13). This agrees with the findings of Xingzhong Hu *et al.* in China (14) and Ressaire Q *et al.* in France

(15). This result is close to a study done in Mexico by Osuna-Ramos JF *et al.* (16) and Luorui Shang *et al.* in China (17). The higher serum lipid profile values in overweight COVID-19 patients than the normal-weight COVID-19 patients are probably due to increased fatty acid in adipose tissue and increased lipid synthesis and metabolism. The lipid profiles decrease depending on the severity of the COVID-19 infection, which is similar to the results of Vignesh Chidambaram *et al.* (18).

Conclusion: Cases of COVID-19 seem to have significantly lower lipid profile values than their controls.

Authors' declaration:

Conflicts of Interest: None.

We hereby confirm that all the Figures and Tables in the manuscript are ours.

-Authors sign on ethical consideration's approval-
Ethical Clearance: The project was approved by the local ethical committee in Alzaeim Alazhary University. According to the code number (7678.28-8-2020).

Author Contributions

Study conception & design: (Abdalla E. Al, Hamsa K. Ibrahim, Abuagla M. Dafalla). Literature search: (Hani M. Abdalla, Gad Allah Modawe). Data acquisition: (Hani M. Abdalla³, Gad Allah Modawe). Data analysis & interpretation: (Abdalla E. Al, Hamsa K. Ibrahim, Abuagla M. Dafalla). Manuscript preparation: (Gad Allah Modawe). Manuscript editing & review: (Hani M. Abdalla, Gad Allah Modawe).

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تقييم مستوى الدهون في الدم بين المرضى السودانيين المصابين بـ COVID 19

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خلفية الدراسة: تم ربط جائحة كوفيد-19 باضطراب شحوم الدم لدى المرضى
الهدف من الدراسة: للتحقيق في التغيرات في البروتين الدهني منخفض الكثافة (LDL) - الكوليسترول في الدم، والبروتين الدهني عالي الكثافة (HDL) - الكوليسترول، والبروتين الدهني منخفض الكثافة جداً (VLDL)، والكوليسترول الكلي (TC)، ومستويات الدهون الثلاثية (TG) لدى الأفراد الذين يعانون من عدوى كوفيد-19
المرضى والطريقة: أجريت هذه الدراسة في مستشفى جبرة، ولاية الخرطوم، السودان، في الفترة من فبراير إلى سبتمبر 2021. وكانت عبارة عن دراسة تحليلية خاضعة للرقابة في المستشفى شملت إجمالي 136 شخصاً. ومن بين هؤلاء، كان 68 مريضاً سودانياً أصيبوا بكوفيد-19، بينما كان الـ 68 الآخرون أفراداً أصحاء كانوا بمثابة المجموعة الضابطة. تم جمع البيانات من خلال استبيان، وتم تقدير مستوى الدهون في الدم باستخدام الطرق الطيفية من خلال عملية إنزيمية. تم تحليل البيانات باستخدام برنامج SPSS (V25).
النتائج: ووجدت الدراسة أن المرضى الذين يعانون من كوفيد-19 لديهم مستويات أقل بكثير من LDL و VLDL و TC و TG مقارنة بالمجموعة الضابطة. وكانت القيم p لهذه الاختلافات = 0.001 و 0.002 و 0.000 و 0.001 على التوالي. لم يكن هناك اختلاف كبير في HDL في الدم ومؤشر كتلة الجسم بين المجموعتين. في مجموعة الحالات، كانت مستويات الدهون في الدم (باستثناء HDL) أعلى بشكل ملحوظ لدى الأفراد الذين يعانون من زيادة الوزن مقارنة بأولئك ذوي الوزن الطبيعي. وكانت القيم الأساسية لهذه الاختلافات هي 0.001، 0.002، 0.001، 0.001، 0.001، على التوالي. ومع ذلك، لم يكن هناك اختلاف كبير في مستويات HDL في الدم بين مجموعتي الوزن. ومن المثير للاهتمام أن مستوى الدهون في الدم كان أعلى بكثير في مجموعة التحكم في زيادة الوزن مقارنة بالحالات. وكانت القيم p لهذه الاختلافات هي 0.001 و 0.041 و 0.024 و 0.001 على التوالي. وأخيراً، وجدت الدراسة أن مستوى الدهون في الدم كان أقل بشكل ملحوظ بين مرضى كوفيد-19 المصابين بحالات حادة مقارنة بالمجموعة الضابطة التي كانت قيمة p لها ≤ 0.001 . على وجه الخصوص، كان LDL و TC في الدم أقل بشكل ملحوظ في المرضى مقارنة بالضوابط، حيث كانت قيم P ≥ 0.003 على التوالي. من ناحية أخرى، كان مصطلح TG أعلى بكثير في الحالات من الضوابط مع قيمة p تساوي 0.001. ولم تكن مستويات VLDL و HDL في الدم مختلفة بشكل كبير بين المجموعتين.
الخاتمة: تشير الأبحاث إلى أن الأفراد الذين أصيبوا بكوفيد-19 أظهروا انخفاضاً في قيم الدهون مقارنة بأولئك الذين لم يتأثروا بالفيروس..
الكلمات المفتاحية: الدهون، كوفيد -19، كورونا، السودانيين، الكوليسترول الدهني منخفض الكثافة، الدهون الثلاثية، مؤشر كتلة الجسم.