RESEARCH ARTICLE

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Received: 22.03.2023
Acceptance: 26.06.2023
DOI: 10.18521/ktd.1268351

Konuralp Medical Journal
e-ISSN1309–3878
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Evaluation of Biochemical Parameters of COVID 19 Patients as Biomarkers

ABSTRACT

Objective: Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) has caused a global pandemic with more than 664 million confirmed cases and more than 6.7 million deaths worldwide. In pandemic, several studies have been done about the relationship of some biochemical and hematological parameters with COVID 19 in order to assist diagnosis and treatment. However, a lot of information is not completely complete and there are contradictions in the data. In the present study, it was focused to compare the biochemical parameters of patients and healthy individuals due to COVID 19 by investigating the relationship between age and gender.

Methods: The 317 individuals who consulted to the Pandemic Outpatient Clinic with the suspicion of COVID 19 between February 2022 and November 2022 were evaluated by laboratory tests. In present study, biochemical parameter values of individuals with positive and negative COVID 19 test outcomes were used as material. These biochemical parameters were compared statistically based on different age ranges and gender groups.

Results: It was ascertained that the values such as urea (UREA), creatine (KREA), ferritin (FER), aspartate transaminase (AST), alanine transaminase (ALT), high sensitivity troponin I (HSTI), creatine kinase (CK) and C reactive protein (CRP) in male patients with COVID 19 were higher than female patients with COVID 19. Moreover, it was detected that there was a statistically significant increase in parameters such as GLU, FER, AST, lactate dehydrogenase (LDH), HSTI, CK and CRP in COVID 19 patients aged 18-65 years.

Conclusions: Many biomarkers of prognostic importance are expensive, ordinary and pricey-effective biomarkers such as FER, AST, LDH, HSTI, CK and CRP can be used to monitor disease in patients with COVID 19 infection.

Keywords: Biochemical Parameters, Biomarkers, COVID 19, Laboratory Diagnosis, SARS-CoV-2.

COVID 19 Hastalarının Biyokimyasal Parametrelerinin Biyobelirteç Olarak Değerlendirilmesi

ÖZET

Amaç: Şiddetli Akut Solunum Sendromu-Coronavirus-2 (SARS-CoV-2), Dünya çapında 664 milyondan fazla doğrulanmış vaka ve 6,7 milyondan fazla ölümle küresel bir pandemiye neden olmuştur. Pandemide tanı ve tedaviye yardımcı olmak amacıyla bazı biyokimyasal ve hematolojik parametrelerin COVID 19 ile ilişkisi üzerine birçok çalışma yapılmıştır. Ancak pek çok bilgi tam değildir ve verilerde çelişkiler vardır. Bu çalışmada yaş ve cinsiyet ilişkisi araştırılarak COVID 19 nedeniyle hasta ve sağlıklı bireylerin biyokimyasal parametrelerinin karşılaştırılması amaçlanmıştır.

Gereç ve Yöntem: Şubat 2022-Kasım 2022 tarihleri arasında Pandemi Polikliniği'ne COVID 19 şüphesiyle başvuran 317 kişi laboratuvar testleri ile değerlendirilmiştir. Bu çalışmada materyal olarak, COVID 19 test sonuçları negatif ve pozitif olan bireylerin biyokimyasal parameter değerleri kullanılmıştır. Bu biyokimyasal parametreler farklı yaş aralıkları ve cinsiyet grupları baz alınarak istatistiksel olarak karşılaştırılmıştır.

Bulgular: COVID 19 erkek hastalarda ÜRE, kreatin (KREA), ferritin (FER), aspartat transaminaz (AST), alanin transaminaz (ALT), Yüksek Hassasiyetli Troponin I (HSTI), kreatin kinaz (CK), C reaktif protein (CRP) gibi değerlerin COVID 19 kadın hastalara göre daha yüksek olduğu belirlenmiştir. Ayrıca 18-65 yaş arası COVID 19 hastalarında GLU, FER, AST, laktat dehidrogenaz (LDH), HSTI, CK ve CRP gibi parametrelerde görülen yükselmenin istatistiksel olarak anlamlı olduğu tespit edilmiştir.

Sonuç: Prognostik öneme sahip birçok biyobelirteçlerin pahalı olmasına karşı COVID 19 enfeksiyonu olan hastalarda hastalığın izlenmesi amacıyla basit ve uygun maliyetli FER, AST, LDH, HSTI, CK ve CRP gibi biyokimyasal parametrelerin biyobelirteç olarak kullanımı söz konusudur.

Anahtar Kelimeler: Biyokimyasal parametreler, Biyobelirteç COVID 19, laboratuvar tanısı, SARS-CoV-2.

INTRODUCTION

Coronaviruses can cause ailments ranging from the common cold to severe acute respiratory diseases in humans (1). Viruses such as Severe Acute Respiratory Syndrome-Coronavirus (SARS-CoV) that cause SARS, Middle East Respiratory Syndrome-Coronavirus (MERS-CoV) that cause MERS, and, Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) that cause COVID 19, classified in the beta-coronavirus family, are named separately due to some differences (1). SARS-CoV first appeared in southern China in 2002 and subsequently affected approximately 8,000 people in 26 countries (2). MERS-CoV first emerged in Saudi Arabia in 2012 and infected 2494 people (3). SARS-CoV-2 expanded all over the world, causing the pandemic (4, 5).

SARS-CoV-2 is recognized as a novel species of the Coronoviridae family due to its high contagiousness (6). Accordingly, the World Health Organization, 203 countries have been affected by the virus. However, there were more than 664 million verified occurrence and more than 6.7 million deaths worldwide, according to data released on January 22, 2023 (7). Considering both the number of viruses affected and the number of cases resulting in death, SARS-CoV-2 has been appeared to be more pathogenic and deadly than previous coronaviruses (SARS-CoV and MERS-CoV) (8). Because the contagion and infection rate of SARS-CoV-2 is quite high (8). Sequence analyzes show that SARS-Cov-2 shows 79% and 50% homology with SARS-CoV and MERS-CoV, respectively. (9).

The lack of information and information pollution experienced at the beginning of the pandemic has been tried to be eliminated by research. Thanks to many recent studies, valuable information has been obtained in terms of both laboratory and clinical findings of hospitalized patients with COVID 19 (10, 11). However, much information was not fully completed, and conflicts were found in the available data (11). The ongoing pandemic and the rapid rise in the number of cases, especially in the last months, need to clearly demonstrate the correlation between both laboratory and clinical findings of COVID 19 patients. More than 11 million cases and more than 55,000 new deaths were recorded in the world in 28 days (26 December 2022 - 22 January 2023) (7).

It is seen that the pandemic continues, and the death rates are increasing rapidly. In this regard, there is a necessity for investigations that can help define critical determinants and provide early appropriate clinical intervention by analyzing the biochemical parameters of COVID 19 patients (12). There are many studies on the relationship of some blood parameters with COVID 19 (4,11,13,14). Each study contains very important data in terms of strategies to be developed in the fight against the disease. Some biochemical and hematological parameters reveal the mortality relationship of COVID 19 patients and can also help the treatment process (13,14).

In this study designed for this purpose, biochemical parameters such as Glucose (GLU), Urea (URE), Creatine (KRE), Ferritin (FER), Lactate Dehydrogenase (LDH), Aspartate Transaminase (AST), Alanine Transaminase (ALT), Sodium (Na), Calcium (Ca), Potassium (K), Hs-Troponin I (HSTI), Creatine Kinase Myocardial Band (CK-MB), Creatine Kinase (CK), Magnesium (Mg), and C-Reactive Protein (CRP) in blood samples taken from COVID 19 positive and negative patients were examined and the changes in these parameters depending on age and gender were examined.

MATERIAL AND METHODS

Ethical Consideration: The study was accomplished with the permission of Düzce Atatürk State Hospital and Düzce University Non-Interventional Health Research Ethics Committee dated 25.04.2022 and numbered 2022-19.

Study Design: In this study, some biochemical data of 317 individuals who applied to Düzce Atatürk State Hospital COVID 19 Pandemic Outpatient Clinic between February 2022 and November 2022 were evaluated. Biochemistry laboratory results and demographic (age and gender) findings of patients and healthy individuals were analyzed retrospectively. Patients with (+) and (-) PCR tests were included in the study. Patients with non-reference values due to malignant and chronic diseases were excluded from the study.

Data Collection: First, oropharyngeal-nasopharyngeal swab samples taken from patients who were have symptoms of COVID 19 were analyzed with a Real-Time PCR device (BioRad® CFX96 Touch C1000, Real Time PCR). A total of 268 people (Female: 171, Male: 97) with positive PCR test and 49 people (Female: 25, Male: 24) with negative PCR test (as control group) were included in the study. Then, the blood samples of 317 individuals taken into gel tubes were centrifuged (Nüve® NF 1200R) and used in the analysis of serum biochemical parameters. GLU, URE, KRE, FER, AST, ALT, LDH, Ca, Na, K, CK-MB, HSTI, CK, Mg and CRP biochemical parameters were analyzed with Alinity® Abbott Autoanalyzer Biochemistry Instrument (Shenzhen, China). The individuals included in the research were divided into four groups according to their age ranges (Group-1: 0-17years old; Group-2: 18-65years old; Group-3: 66-79years old; Group-4: 80-99years old).

Statistical Analysis: Statistical analysis was implemented using IBM SPSS 20.0 (SPSS for

Windows, SPSS Inc., Chicago, IL, USA). In descriptive statistics, numerical variables were given as mean and standard deviation. In addition, Kolmogorow – Smirnov test was used in the analysis of numerical data not suitable for normal distribution. p values <0.05 were approved statistically significant.

RESULTS

In our study, it was detected that the age of COVID 19 negative individuals (n=49) was between 1–83, and the age of COVID 19 positive individuals (n=268) was between 1–92.

In this study, there were 51% female (n=25) and 49% male (n=24) individuals in the COVID 19 negative control group, and 64% female (n=171) and 36% male (n=97) individuals in the COVID 19 positive patient group (Figure 1). In total, it was determined that 61.83% and 38.17% were female (n=196) and male (n=121) of all individuals, respectively.

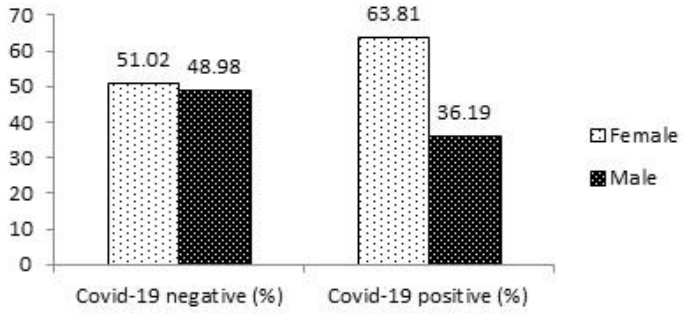

Figure 1. Distribution rates of Covid-19 positive and negative patients by gender

In our study, the age distribution among the control group and the patient study group is also shown in Figure 2 for 4 different age ranges: 0-17, 18-65, 66-79 and 80-99 age ranges. According to the data here, the 18-65 age range has the highest number of individuals in both COVID 19 negative and COVID 19 positive patients, and it is seen that the number of women is higher. The age range of 80-99 has the lowest number of individuals and the number of women is found to be higher.

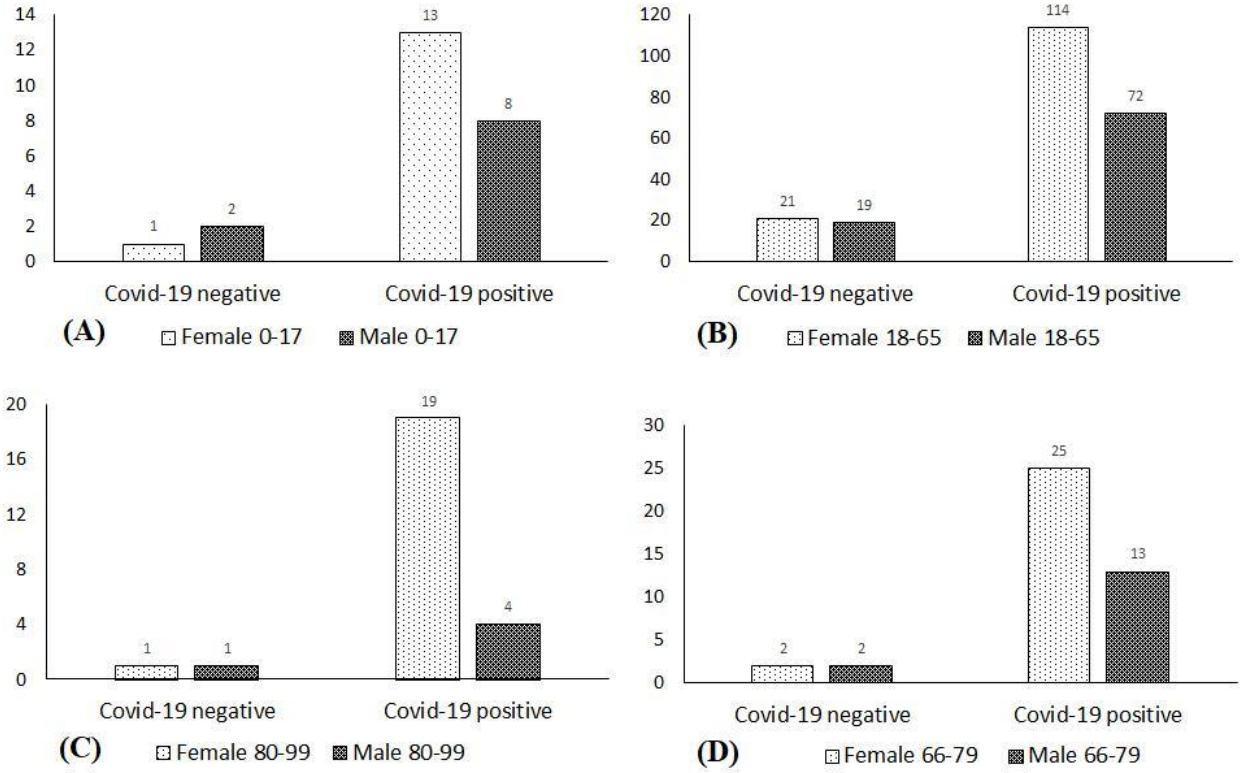

Figure 2. Distribution of Covid-19 negative and positive patients according to gender and age ranges.

The comparison of the biochemical parameter results of the COVID 19 negative (control) groups and the COVID 19 positive (patient) groups is shown in Table 1 separately for women and men. When the results obtained from biochemical parameters were investigated whether

Table 1. Evaluation of the biochemical parameter values of the individuals between the control group and the patient study group acc

Test Parameters	Reference Ranges	Control Groups (N=25)	Patient Groups (N= 171)	Significance Level (P)	Control Groups (N=24)
		Female			Mal
GLU (mg/dL)	70-105	**98.08 ± 9.82**	**131.57 ± 64.99**	**0.002****	101.04 ± 11.40
URE (mg/dL)	15-45	24.52 ± 6.64	27.04 ± 13.22	0.641	26.91 ± 8.69
KREA (mg/dL)	0.5-1.1	0.85 ± 0.23	0.85 ± 0.41	0.510	**0.84 ± 0.14**
FER (ng/mL)	10-204	91.52 ± 55.25	141.09 ± 241.07	0.354	**92.48 ± 45.08**
AST (U/L)	5-34	24.64 ± 8.00	27.40 ± 14.25	0.431	**22.41 ± 6.06**
ALT (U/L)	0-55	25.68 ± 7.20	24.08 ± 13.25	0.122	**24.58 ± 7.63**
LDH (U/L)	125-220	**188.72 ± 36.51**	**247.97 ± 86.23**	**0.001*****	**180.40 ± 26.90**
Ca (mg/dL**)**	8.4-10.2	8.74 ± 0.45	10.41 ± 22.51	0.899	8.85 ± 0.50
Na (mol/L)	135-145	139.20 ± 3.87	138.96 ± 10.59	0.873	139.91 ± 2.22
K (mol/L)	3.5-5.1	4.19 ± 0.38	4.92 ± 10.32	0.680	4.12 ± 0.39
CK-MB(ng/mL)	0-7.2	0.63 ± 0.56	0.84 ± 0.96	0.375	0.55 ± 0.39
HSTI (pg/mL)	0-33	**0.90 ± 0.95**	**50.67 ± 129.78**	**0.000*****	**0.86 ± 0.90**
CK (U/L)	30-200	**51.28 ± 25.07**	**48.22 ± 62.65**	**0.002****	**56.29 ± 21.56**
Mg (mg/dL)	1.6-2.6	1.88 ± 0.19	4.45 ± 33.11	0.388	1.89 ± 0.25
CRP (mg/dL)	0-0.5	**0.62 ± 0.70**	**2.49 ± 4.35**	**0.048***	**0.67 ± 0.80**

* For the test parameter values with $p<0.05$, the difference between the groups was found to be significant. Calculated considering the Mean ± Standard Deviation.

Table 2. Evaluation of the biochemical parameter values of the individuals in the control group and the patient study group according

Test Parameters	Reference Ranges	Control Groups		Significance Level (P)	Patient
		Female	Male		Female
GLU (mg/dL)	70-105	98.08 ± 9.82	101.04 ± 11.40	0.356	131.57 ± 64.99
URE (mg/dL)	15-45	24.52 ± 6.64	26.91 ± 8.69	0.759	27.04 ± 13.22
KREA (mg/dL)	0.5-1.1	0.85 ± 0.23	0.84 ± 0.14	0.740	0.85 ± 0.41
FER (ng/mL)	10-204	91.52 ± 55.25	92.48 ± 45.08	0.536	141.09 ± 241.07
AST (U/L)	5-34	24.64 ± 8.00	22.41 ± 6.06	0.105	27.40 ± 14.25
ALT (U/L)	0-55	25.68 ± 7.20	24.58 ± 7.63	0.955	24.08 ± 13.25
LDH (U/L)	125-220	188.72 ± 36.51	180.40 ± 26.90	0.185	247.97 ± 86.23
Ca (mg/dL)	8.4-10.2	8.74 ± 0.45	8.85 ± 0.50	0.364	10.41 ± 22.51
Na (mol/L)	135-145	139.20 ± 3.87	139.91 ± 2.22	0.740	138.96 ± 10.59
K (mol/L)	3.5-5.1	4.19 ± 0.38	4.12 ± 0.39	0.778	4.92 ± 10.32
CK-MB(ng/mL)	0-7.2	0.63 ± 0.56	0.55 ± 0.39	0.814	0.84 ± 0.96
HSTI (pg/mL)	0-33	0.90 ± 0.95	0.86 ± 0.90	1.000	50.67 ± 129.78
CK (U/L)	30-200	51.28 ± 25.07	56.29 ± 21.56	0.527	48.22 ± 62.65
Mg (mg/dL)	1.6-2.6	1.88 ± 0.19	1.89 ± 0.25	0.778	4.45 ± 33.11
CRP (mg/dL)	0-0.5	0.62 ± 0.70	0.67 ± 0.80	1.000	2.49 ± 4.35

* For the test parameter values with $p<0.05$, the difference between the groups was found to be significant. Calculated considering the Mean ± Standard Deviation.

Table 3. Comparison of the biochemical parameters of the individuals in the control and patient groups according to different age ranges

Test Parameters	0-17 age range			18-65 age range			66-79 age range		
	Control Groups (N=3)	Patient Groups (N= 21)	p	Control Groups (N=40)	Patient Groups (N= 186)	p	Control Groups (N=4)	Patient Groups (N= 38)	p
GLU(mg/dL)	94.00 ± 11.13	136.38 ± 83.04	0.932	98.72 ± 9.36	123.74 ± 57.37	**0.000*** **	106.50 ± 19.07	139.86 ± 67.31	0.710
URE(mg/dL)	30.66 ± 18.90	27.80 ± 16.92	1.000	23.92 ± 5.36	28.91 ± 15.86	0.141	37.00 ± 4.69	33.52 ± 13.90	0.391
KREA(mg/dL)	0.76± 0.12	0.80 ± 0.22	0.983	0.83 ± 0.20	0.94 ± 0.77	0.305	0.87 ± 0.60	1.02 ± 0.73	0.464
FER (ng/mL)	40.23 ± 38.22	157.44 ± 257.87	0.721	96.63 ± 48.30	225.22 ± 339.12	**0.001*** **	96.84 ± 68.17	278.23 ± 424.41	0.828
AST (U/L)	19.33 ± 10.59	33.00 ± 22.27	0.591	23.22 ± 6.71	31.00 ± 17.67	**0.021***	28.50 ± 9.53	31.10 ± 16.92	0.997
ALT (U/L)	17.00 ± 8.71	28.57 ± 24.43	0.841	25.72 ± 6.65	29.34 ± 22.22	0.110	28.75 ± 11.05	27.21 ± 14.64	0.668
LDH (U/L)	154.86 ± 18.83	279.28 ± 263.72	0.095	184.55 ± 33.26	261.02 ± 105.33	**0.000*** **	206.50 ± 17.63	277.57 ± 108.95	0.141
Ca (mg/dL)	8.60 ± 1.11	8.71 ± 0.46	0.983	8.82 ± 0.42	10.30 ± 21.58	0.501	8.95 0.44	8.55 ± 0.67	0.326
Na (mol/L)	139.66 ± 1.52	139.23 ± 4.03	0.983	140.07 ± 2.95	139.10 ± 10.02	0.985	135.25 ±3.50	139.47 ± 5.45	0.326
K (mol/L)	4.46 ± 0.41	4.06 ± 0.41	0.467	4.13 ± 0.39	4.86 ± 9.89	0.999	4.30 ± 0.24	4.28 ± 0.45	0.997
CK-MB(ng/mL)	0.83 ± 0.75	1.62 ± 3.33	0.932	0.58 ± 0.44	0.79 ± 0.97	0.890	0.35 ± 0.10	1.28 ± 1.30	0.141
HSTI (pg/mL)	0.53 ± 0.46	70.15 ± 102.38	0.095	0.89 ± 0.99	103.33 ± 407.73	**0.000*** **	1.05 ± 0.17	87.58 ± 135.08	**0.006** **
CK (U/L)	39.33 ± 10.69	49.32 ± 68.78	0.467	55.85 ± 24.67	60.97 ± 87.26	**0.000*** **	45.25 ± 11.67	65.72 ± 124.92	0.219
Mg (mg/dL)	2.01 ± 0.25	1.90 ± 0.24	0.591	1.89 ± 0.22	1.93 ± 0.25	0.890	1.80 ± 0.08	13.31 ± 70.25	0.296
CRP (mg/dL)	0.30 ± 0.30	2.15 ± 5.62	0.983	0.61 ± 0.71	3.22 ± 4.94	**0.000*** **	1.32 ± 1.22	4.00 ± 5.13	0.710

* For the test parameter values with $p<0.05$, the difference between the groups was found to be significant. Calculated considering the Mean ± Standard Deviation.

there was a difference between individuals of the same sex, statistical significance was found between GLU, LDH, HSTI, CK and CRP values in women. In males, statistical significance was found between CREA, FER, AST, ALT, LDH, HSTI, CK and CRP levels**.**

The data of COVID 19 negative women were contrasted with that of COVID 19 negative men; the data of COVID 19 positive women were compared with that of COVID 19 positive men in Table 2. According to the results obtained, it is seen that the gender difference among individuals who are negative for COVID 19 is not statistically significant. However, it has been determined that UREA, CREA, FER, AST, ALT, HSTI, CK, CRP values are higher in patients with COVID 19 positive patients and this increase is statistically significant.

Considering the age distributions between COVID 19 negative and positive groups; Statistical data of biochemical factors determined for the age ranges of 0-17, 18-65, 66-79, 80-99 for both groups are shown in Table 3. Accordingly, for the COVID 19 negative (control) group; it has been determined that K and Mg values are highest in the 0-17 age range, Na and CK values are the highest in the 18-65 age range. Furthermore, it was detected that UREA, FER, AST, ALT, LDH, Ca, CK-MB, HSTI and CRP levels are the highest in the 66-79 age range and, GLU, KREA and CK-MB levels are the highest in 80-99 age range. For the patient group who are positive for COVID 19; AST, LDH and CK-MB in the 0-17 age range; ALT, Ca, K and HSTI in the 18-65 age group; KREA, FER, CK and Mg in the age range of 66-79; GLU, UREA and Na values were found to be the highest in the age range of 80-99 years.

In our study, the biochemical parameters of individuals in different age ranges in the control group and individuals in different age ranges in the patient group were compared (Table 3). According to this; There was no statistically significant difference between the control group and the patient group in the 0-17 age range When the data of the control and patient groups for the 18-65 age range were compared; GLU, FER, AST, LDH, HSTI, CK and CRP values were statistically significant; for the 66-79 age range, only the HSTI value was statistically significant between the control and patient groups. For the 80-99 age range, there was no statistically significant difference between the control and patient groups.

DISCUSSION

In our study, regardless of age, considering gender; It has been determined that UREA, CREA, FER, AST, ALT, HSTI, CK, CRP values are higher in men who are positive for COVID 19 than in women. Similarly, Atici et al. (2022) investigated the changes in hematological and inflammatory parameters according to age and gender in patients with COVID 19 positive at Lokman Hekim University Ankara Hospital (15). When the correlations of these parameters with age were examined, CRP, LDH and FER values displayed a unextreme correlation; when evaluated according to gender, they determined that it was higher in male patients. It is thought that these differences between men and women may be due to the sex hormones that change with age, and therefore the cause of the different severity of COVID 19 in men and women (16).

In present study, it was detected that there was a statistically significant increase in all of the GLU, FER, AST, LDH, HSTI, CK and CRP values in COVID 19 positive patients aged 18-65, regardless of gender. For the patient group between the ages of 66-79, it was found that there was only a statistically significant increase in the HSTI value. Similarly, there are many studies about biochemical parameters. Kar et al. (2022) examined the impacts of COVID 19 on biochemical and hematological parameters in individuals who applied to Eskisehir City Hospital, they found that ALT, AST, CRP, Ferritin, Creatinine, LDH and Troponin levels were high in patients with positive (17). Guneysu et al. (2021) reported that there was a statistically significant difference in terms of CRP, ferritin and LDH values in COVID 19 patients (18). Harbalioglu et al. (2021) found that LDH, CRP, ferritin values were statistically significant in inpatients, but there was no change in GLU, CREA, ALT and AST values (19).

In the study of Balcı et al. (2021), in which they evaluated full blood count and biochemical parameters in the all groups admitted to Mersin University Hospital, it was determined that the CRP value was higher in the patient groups. There is no significant difference in other biochemical parameters (CREA, ALT and AST) (20).

However, as can be seen, while GLU, CREA, AST, and ALT had significantly higher values in some studies, no significant difference was observed in some studies. Unfortunately, the contradictions between the results still persist. In this context, other factors that trigger changes in these parameters should also be taken into account. For example, Sarhan et al. (2021), in their study at Al-Hussein Teaching Hospital (Thi-Qar Province, Iraq) to investigate the interaction between some clinical features (non-smokers, non-diabetic, etc.) and biochemical parameters, they determined several potential biochemical indices and whether certain comorbidities and clinical features affect these markers (21).

In our study, GLU, FER, AST, LDH, HSTI, CK and CRP levels, which are routine biochemistry tests, were found to be high regardless of gender, when age is taken into account. There are studies emphasizing a direct relationship between glycemic control and COVID 19, and the relationship between glucose levels and disease severity (22,23).

Although high ferritin values are observed in

bacterial rather than viral infection, in the context of COVID 19, high ferritin levels may have pointed out violent secondary bacterial infection. Therefore, it is used as a marker for poor prognosis. In addition, it has been shown that higher serum ferritin value is correlated with acute respiratory distress syndrome, mortality, and severe COVID 19 (24).

Abnormalities in liver function tests can be used as a predictor to monitor disease severity. AST is one of them. It has shown that the probability of progression in violent COVID 19 is significantly higher. There are also researches showing that the use of therapeutic antiviral drugs increases the likelihood of liver damage fourfold. (25). Since the primary area affected by SARS-CoV-2 is the lower respiratory tract and LDH is an important indicator of lung damage, it is thought that LDH levels are high in patients with COVID 19 positive.

HSTI and CK are important biomarkers, so an increase in HSTI (in myocardium) and CK (in skeletal muscle, heart muscle and brain) levels indicates that damage may occur in the relevant regions. As one of the mechanisms in the occurrence of myocardial damage, plaques may break off due to the increase in oxygen demand and cause sudden occlusions (26).

Although CRP levels, which are one of the other biochemical parameters, are seen to increase in bacterial infections contrasted to viral infections, many studies have reported that CRP levels are high in COVID 19 patients (27). IFCC guidelines recommended the inclusion of CRP as one of the markers for assessment of infection severity, prognosis, and therapeutic monitoring (28).

CONCLUSION

In conclusion, evaluation of biochemical parameters is one of the cornerstones of laboratory medicine. Because many biomarkers of prognostic importance are expensive, ordinary and pricey-effective biomarkers such as FER, AST, LDH, HSTI, CK and CRP can be used to monitor disease in patients with COVID 19 infection.

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