ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Assessment of variations in selective biochemical parameters and its correlation with age and gender in COVID-19 patients of Ujjain district: A retrospective study

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Submission: 19-01-2021 Revision: 29-04-2022 Publication: 01-05-2022

ABSTRACT

Background: At Ujjain district, in which the current study is based, has no prior studies examining the variations of liver function tests in the resident population. **Aims and Objectives:** The present study was undertaken to assess the variation in selective biochemical parameters and their correlation with age and gender in COVID-19 patients of Ujjain district: A retrospective study. **Materials and Methods:** 199 cases of confirmed COVID-19 patients from June 2020 to November 2020 were admitted to R. D. Gardi Medical College, Ujjain, Madhya Pradesh, were part of the study. Aspartate aminotransferases (AST), Alanine aminotransferases (ALT), Alkaline phosphatases (ALP), Total protein (TP), Total bilirubin (TB), C-reactive protein (CRP), Lactate dehydrogenase (LDH), sodium, and potassium parameters were recorded in the study participants. AST, ALT, TP, TB, CRP, and LDH were analyzed using vitros 5600 integrated system which is a dry chemistry autoanalyzer of ortho clinical diagnostics. Sodium and potassium analysis were analyzed on the vitros 5600 integrated system by using the direct potentiometry principle. The data were obtained from the patient information sheet from the MRD of our hospital. **Results:** The study results present the age-wise and gender-wise correlation of the parameters. There was an increase in the AST, ALT, CRP, and LDH levels in both male and female participants. However, the difference is not statistically significant. ALP, TP, TB, and potassium levels are within the normal limits in male and female participants. Albumin levels were decreased in male and female participants. However, the difference was not statistically significant. Sodium levels were significantly decreased ($P<0.05$) in males when compared with females. **Conclusion:** The study assessed the variations in selective biochemical parameters and their correlation with inflammatory markers in COVID-19 patients of the Ujjain district. The study results help to understand the biochemical aspects of the Covid disease. Further, detailed studies are recommended to understand the role of the biochemical parameter which helps for early diagnosis to save the life of the covid patients in general.

Key words: COVID-19 testing; Biomarkers; Early diagnosis

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v13i5.42506

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

From its inception in China in the year 2019, the Coronavirus has spread throughout the world and become a global pandemic.[1] To date, it is a preliminary global issue to deal with. The entire scientific community throughout the world, currently working to understand the virus and its effects on different body systems and to develop effective

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management strategies. Currently, the viral infection can be diagnosed by either antigen testing or by RTPCR, or by antibody titer.[2] Understanding the effect of the virus on the biochemical parameters gives an additional diagnostic tool and also helps to develop treatment plans. It was known that lungs are primarily affected by the virus but there is evidence that organs like the liver, spleen, and heart are also not spared. Hence, it is needed for time to understand the effects on other systems also to develop better treatment protocols and save many lives. The study helps to understand the variations in biochemical parameters in COVID patients which helps for a better understanding of the pathophysiology of COVID-19. The study adds to the existing knowledge and contributes to planning better treatment strategies that help society in general. At Ujjain district, in which the current study is based, has no prior studies examining the variations of liver function tests in the resident population. Hence, the present study was undertaken to assess the variations in selective biochemical parameters and their correlation with age and gender in COVID-19 patients of Ujjain district.

Aims and objectives

The present study was undertaken to assess the variations in selective biochemical parameters and their correlation with age and gender in COVID-19 patients of Ujjain district.

MATERIALS AND METHODS

Study design

Retrospective study.

Study setting

The present study was conducted at the Department of Biochemistry in collaboration with the Department of Physiology, R.D. Gardi Medical College, Ujjain, Madhya Pradesh, India.

Study participants

199 cases of confirmed COVID-19 patients from June 2020 to November 2020 admitted in R. D. Gardi Medical College, Ujjain, Madhya Pradesh, were part of the study.

Inclusion criteria

All COVID-19 positive patients of 18 years of age and above were included in the study.

Exclusion criteria

Participants suffering from chronic liver diseases, alcoholism, hepatitis, pregnant women were excluded from the study.

Methods

Aspartate aminotransferases (AST), Alanine aminotransferases (ALT), Alkaline phosphatases (ALP), Total protein (TP), Total bilirubin (TB), C-reactive protein (CRP), Lactate dehydrogenase (LDH), sodium, and potassium parameters were recorded in the study participants. AST, ALT, TP, TB, CRP, LDH were analyzed using vitros 5600 integrated system which is a dry chemistry autoanalyzer of ortho clinical diagnostics. Sodium and potassium analysis were analyzed on the vitros 5600 integrated system by using the direct potentiometry principle. The data was obtained from the patient information sheet from the MRD of our hospital.

Statistical analysis

Data was analyzed by SPSS 20.0. Categorical variables will be expressed as percentages. The difference between categorical variables was examined with a chi-square test. Correlation analysis was done using the Pearson correlation coefficient.

Ethical considerations

The study protocol was approved by the institutional human ethical committee of R.D. Gardi Medical College (IEC Ref. No: 03/2021 dated 24/06/2021). Permission was obtained from the Head of the Department, Department of Biochemistry for collection of the data.

RESULTS

Results were presented in Tables 1-5. For AST, ALT, ALP, TP, albumin, TB, CRP, LDH, potassium the difference in the mean values among the different levels of Gender-Category is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Age-Category. There is not a statistically significant difference for AST (P=0.226), ALT (P=0.292), ALP (P=0.146), TP (P=0.285), albumin (P=0.501), TB (P=0.630), CRP (P=1.000), LDH (P=0.339) and potassium (P=0.746) respectively. For sodium, the difference in the mean values among the different levels of Gender-Category is greater than would be expected by chance after allowing for effects of differences in Age-Category. There is a statistically significant difference (P=0.036).For AST, ALT, TP, albumin, TB, CRP, sodium and potassium the difference in the mean values among the different levels of Age-Category is not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Gender-Category. There is not a statistically significant difference for AST (P=0.488), ALT (P=0.531), TP (P=0.073), albumin (P=0.419), TB (P=0.070) CRP (P=0.325), sodium (P=0.066) and potassium (P=0.638), respectively. For ALP, LDH the difference in the mean values among the different levels of Age-Category is greater than would be expected by chance after allowing

Table 1: Statistical analysis of AST, ALT, and ALP of gender and age category by 2-way ANOVA with Bonferroni t-test

S. No.	Factors and significance	AST	ALT	ALP
1	Factor 1, Gender (male and female)	F=1.477 P=0.226	F=1.117 P=0.292	F=2.126 P=0.146
2	Factor 2, Age (<60 and>61 years)	F=0.484 P=0.488	F=0.394 P=0.531	F=7.453 P=0.007*
3	Interaction, Gender x Age	F=0.294 P=0.588	F=0.258 P=0.612	F=2.189 P=0.141
4	Significance of age category Within male	-	-	t=1.123 P=0.263
5	Significance of age category Within female	-	-	t=2.534 P=0.012*
6	Significance of gender Within<60 years	-	-	t=2.354 P=0.020*
7	Significance of gender Within>61 years	-	-	t=0.0136 P=0.989

n=199. *P<0.05 is significant

Table 2: Statistical analysis of TP, and TB of gender and age category by 2-way ANOVA with Bonferroni t-test

S. No.	Factors and significance	TP	Albumin	TB
1	Factor 1, Gender (male and female)	F=1.148 P=0.285	F=0.455 P=0.501	F=0.233 P=0.630
2	Factor 2, Age (<60 and>61 years)	F=3.243 P=0.073	F=0.655 P=0.419	F=3.330 P=0.070
3	Interaction, Gender x Age	F=1.304 P=0.255	F=2.742 P=0.099	F=3.026 P=0.084
4	Significance of age category Within male	-	-	-
5	Significance of age category Within female	-	-	-
6	Significance of gender Within<60 years	-	-	-
7	Significance of gender Within>61 years	-	-	-

n=199

for the effects of differences in Gender-Category. There is a statistically significant difference for ALP (P=0.007), LDH (P=0.049) respectively. For AST, ALT, ALP and TP, albumin, TB, CRP, LDH, sodium, and potassium the effect of different levels of Gender-Category does not depend on what level of Age-Category is present. There is not a statistically significant interaction between Gender-Category and Age-Category for AST (P=0.588), ALT (P=0.612), ALP (P=0.141), TP (P=0.255), albumin (P=0.099) TB (P=0.084), CRP (P=0.103), LDH (P=0.081), sodium (P=0.167), and potassium (P=0.151), respectively (Tables 1-3).

There was an increase in the AST, ALT, CRP, and LDH levels in both male and female participants. However, the difference is not statistically significant. ALP, TP, TB, and potassium levels are within the normal limits in male and female participants. Albumin levels were decreased in male and female participants. However, the difference was not statistically significant. Sodium levels were significantly decreased (P<0.05) in males when compared with females (Table 4).

There was an increase in the AST, ALT, CRP levels in both <60 years and >60 years of age group participants. However, the difference is not statistically significant. LDH levels were significantly higher in the participants of <60 years of age group. A significant increase in the ALP levels was observed in the age group of <60 years when compared with the age group of >60 years (P<0.001). TP, TB, and potassium levels are within the normal limits in both <60 years and >60 years of age group participants. But TB values were significantly high in the participants of <60 years of age. There was a decrease in the albumin, sodium levels in both <60 years and >60 years of age group participants. However, the difference is not statistically significant.

DISCUSSION

The present study was undertaken to assess variations in selective biochemical parameters and their correlation with inflammatory markers in COVID-19 patients of the Ujjain district. For sodium, the difference in the mean values among the different levels of Gender-Category is greater than would be expected by chance after allowing for the effects of differences in Age-Category. There is a statistically significant difference (P=0.036). For ALP, LDH the difference in the mean values among the different levels of Age-Category is greater than would be expected by chance after allowing for the effects of differences in Gender-Category. There is a statistically significant difference for ALP (P=0.007), LDH (P=0.049) respectively.

COVID-19 is a global pandemic and early diagnosis and hospitalization have great importance in saving the patient life. The virus was reported to cause a response from both innate and adaptive immunity.[3] It causes hyper inflammation through this as there will be a loss of balance between the different forms of T cells. Increased levels of CRP and LDH were reported in earlier studies.[4-7] Another study reported great raise in the levels of interleukins in Covid patients.[8-10] Significant decreases in the serum albumin levels were reported in Covid patients. This is

Table 3: Statistical analysis of CRP, LDH, Sodium (Na) and Potassium (K) of gender and age category by 2-way ANOVA with Bonferroni 't-test.

S. No.	Factors and significance	CRP	LDH	Na	K
1	Factor 1, Gender (male and female)	F=0.000 P=1.0	F=0.921 P=0.339	F=4.472 P=0.036*	F=0.105 P=0.746
2	Factor 2, Age (<60 and>61 years)	F=0.974 P=0.325	F=3.912 P=0.049*	F=3.423 P=0.066	F=0.223 P=0.638
3	Interaction, Gender x Age	F=2.681 P=0.103	F=3.086 P=0.081	F=1.926 P=0.167	F=2.081 P=0.151
4	Significance of age category Within male	-	t=0.199 P=0.843	t=2.895 P=0.004**	-
5	Significance of age category Within female	-	t=2.247 P=0.026*	t=0.279 P=0.781	-
6	Significance of gender Within<60 years	-	t=2.169 P=0.031*	t=0.584 P=0.560	-
7	Significance of gender Within>61 years	-	t=0.511 P=0.610	t=2.238 P=0.026*	-

n=199. *P<0.05 is significant, **P<0.01 is significant

Table 4: Comparison of variation of the parameters among male and female participants

Parameter	Male (n=138)	Female (n=61)	P-value
AST	83.3±10.5	60.4±15.6	0.2270
ALT	69.9±14.4	42.5±21.5	0.3492
ALP	108.5±6.2	125.0±9.3	0.1419
TP	6.5±0.08	6.3±0.1	0.1474
Albumin	3.4±0.05	3.3±0.07	0.2596
TB	0.9±0.1	1±0.1	0.5441
CRP	10652.2±1145.4	10652.6±1726.5	0.9998
LDH	417.3±34.7	477.3±51.9	0.3388
Sodium	133.6±0.5	135.7±0.8	0.0237*
Potassium	4.5±0.1	4.4±0.1	0.5441

Data were presented as mean and SEM. *P<0.05 is significant

Table 5: Age-wise comparison of variation of the parameters among the participants

Parameter	<60 years of age (n=108)	>60 years of age (n=91)	P-value
AST	78.4±11.7	65.3±14.7	0.4811
ALT	64.3±16.1	48.0±20.2	0.5238
ALP	132.2±7	101.4±8.8	0.0061**
TP	6.5±0.09	6.3±0.1	0.1381
Albumin	3.4±0.05	3.3±0.07	0.9144
TB	1.1±0.1	0.8±0.1	0.0365*
CRP	11674.9±1339.6	9629.9±1580.6	0.3215
LDH	509.1±39.1	385.5±48.7	0.0467*
Sodium	135.5±0.6	133.7±0.7	0.0510
Potassium	4.4±0.1	4.5±0.1	0.4835

Data were presented as mean and SEM. *P<0.05 is significant. **P<0.01 is significant

true in the case of both mild and severe patients.[11] As it is well known that the Covid virus affects not only the lungs but also affects multiple systems and results in the failure of these organs. The liver is also one of the organs that can be affected by the virus. Increased levels of ALT and AST was observed in these patients.[12,13] Significant liver damage was reported in the patients affected by Covid-19.[14] Further, there was an imbalance of electrolytes in the Covid patients especially those who are severe. Significantly lower levels of sodium, potassium, calcium levels were found in severe Covid patients.[15] As these electrolytes were associated with the vital functions of the body, the levels of these electrolytes must be restored at the earliest in these patients.[16,17]

Limitations of the study

The sample size of the study was less for generalizations.

CONCLUSION

The study assessed the variations in selective biochemical parameters and their correlation with inflammatory markers

in COVID-19 patients of the Ujjain district. The study results help to understand the biochemical aspects of the Covid disease. Further, detailed studies are recommended to understand the role of the biochemical parameter which helps for early diagnosis to save the life of the covid patients in general.

ACKNOWLEDGMENT

The authors sincerely thanks to the management of R.D. Gardi Medical College, Ujjain, for constant support to complete the study.

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PKN and SSKG- Concept and design of the study, collection of data, prepared the first draft of the manuscript; **PMS and GGP-** Interpreted the results, reviewed literature and manuscript preparation; **AP and SG-** Statistical analysis and interpretation and preparation of the manuscript; **VKM-** Preparation of manuscript and revision of the manuscript.

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Source of Funding: None, **Conflicts of Interest:** None.