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Hematological and biochemical parameters changes associated with Coronavirus Disease (COVID-19) for some patients in Missan Province

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Abstract:

   Aim of study: COVID-19 an infectious respiratory illness caused by the severe acute respiratory syndrome–corona virus 2 (SARS-CoV2), has now spread to multiple countries including Iraq, therefore this study aimed at the detection of the relationship of hematological and biochemical markers with SARS-CoV-2 infection in Missan city.

   Method: The study was performed in Period between (First of November -2021 to First of May- 2022), the data and blood samples were collected from 92 (55 males and 37 females) in Maternity and Baby hospital (COVID-19 center).the patients were conformed as positive for SARS-CoV-2 nucleic acid by fluoresce RT-PCR .Each infected patient was subjected to the blood grouping test according to the procedure that described in kit of blood grouping from supplier in Chennai(India). Five (5ml) of venous blood samples were collected, Each blood sample separated into two tubes, The first sample (2ml) of the blood added to EDTA tube for hematological assessment ,the second blood sample (3ml) added to the tube without anticoagulant and centrifugation for (10 minutes) at 3000 rpm , the serum was stored in (-20C°)freezer till handled for biochemical analysis and all biochemical parameters were performed in laboratory of Baby and Maternity hospital according to the standard methods that described in the analysis kits products in Spinach Company Spain react. Complete blood picture (CBC) were shown from the collected blood samples by automatic methods (System X kx-21n automated hematology analyzer; JAPAIN CARE CO., LTD).

   The results: The obtained results from this study observed the males were more infected with COVID -19 in percentage (59.7%) ,while the females were reported (40.2%) of all cases, high incidence of Covid-19 was reported in the ages between (51-60) years in percentage (31.5%)cases, followed by the ages between the years (61 -70 or more) , the infection with Covid-19 found in blood group (A) in percentage (58.6%) , followed by blood group (O) in percentage (28.2%) , the most common symptoms were fever in percentage (66.3%) , cough (45.6%) .

   Hematological analysis the blood samples significant decrease in red blood cells (RBCs) , white blood cells (WBCs) and lymphocytes as compared normal value in (p< 0.05),while the haematocrit(HCT) ,hemoglobin (Hb) ,Platelets (Plt) and neutrophiles observed significant increase as compared with normal values.

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The biochemical analysis observed significant increase in Alkaline phosphatase (76.08%) , creatinine (47.82%),blood urea (66.31%) as compared with normal values. significant increase in AST and ALT) in percentage (63.04%,52.17%) respectively , blood glucose increased in patients (57. 61%) as compared with   normal values , significant increase in the level of blood as compared with normal values .Significant increased LDH (63.04%) , Firritin (78.26%), C-Reactive protein (84.78%) , D.dimer protein (40.21%) as compared with normal values .Lipid profile observed significant increase in total cholesterol in ($P>0.05$) after the infection in percentage (64.1%) , Low-density lipoprotein (LDL) between the patients in percentage (63.04%) , triglyceride were reported significant increase in percentage (59.7%) , very Low density lipoprotein (vLDL) in percentage (68.4%) as compared with the patients that reported normal values.

Conclusion: COVID-19 (SARS-CoV-2) spread quickly and the males and the older ages more likely infected may due aweak in immune response and decline in respiratory function s, blood grouping (A) more infected may be due to the biologic difference among these populations. The study reported hematological and biochemical abnormal changes in patients infected with COVID-19.

Key words: COVID-19 (SARS-CoV-2), hematological, biochemical parameters**,** blood grouping, Missan province.

Introduction:

Corona virus disease is a contagious disease caused by sever acute respiratory syndrome corona virus2 (SARS-CoV-2). The novel coronavirus was first isolated and identified at the end of 2019 and the beginning of 2020, during the initial outbreak in Wuhan , the virus and disease were commonly referred to as "coronavirus" and "Wuhan coronavirus", with the disease sometimes called Wuhan pneumonia (Liu *et al* ,2020).

The coronavirus has a diameter of 80–120 nm and is single-stranded RNA. Four types of virus have been reported, which include α-coronavirus, β-coronavirus, δ-coronavirus, and γ-coronavirus . Infection in humans is caused by six corona viruses, and the 2019 novel coronavirus (SARS-CoV-2) is regarded as the seventh member of the corona virus family to induce infection in humans (Zhu *et al* ,2020). There are four major structural proteins encoded by the corona viral genome on the envelope, one of which is the spike (S) protein that binds to the angiotensin-converting enzyme 2 (ACE2) receptor and mediates subsequent fusion between the envelope and host cell membranes to aid viral entry into the host cell .

Medical staff and family members have reported the presence of individual-to-individual transmission ,where Individual-to-individual transmission was reported to take place by close contact with an infected individual. Transmission normally occurs through breathing droplets from the sneezing and coughing of an infected person. SARS-CoV was discovered to remain on surfaces for about four days while other corona viruses can be seen on surfaces for about nine days (Lie *et al* ,2020).

After entry the virus into the cells of the host organism, the antigen presentation cells (APC) recognize the antigen of the virus. This is vital for the anti-viral immunity of the host cell. The major histocompatibility complex (MHC) in humans, or the human leukocyte antigen (HLA), are involved in the presentation of antigenic peptides, followed by the recognition of the peptide by virus-specific cytotoxic T lymphocytes, presentation of SARS-CoV-2 will aid the understanding of coronavirus disease pathogenesis. The MHC I molecules are largely responsible for the SARS corona virus antigen presentation . However, MHC II also partake in the presentation of antigen (Marik *et al* ,2021) .

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Clinical manifestations include dry cough, chest pain, fever, myalgia, dyspnea and fatigue . Dizziness, abdominal pain, nausea, headache, vomiting and diarrhea are less common clinical presentations . Coronavirus infected individuals presented prominent upper respiratory tract manifestation including sneezing or sore throat, thus proposing that the virus might have higher affinity to harboring with the lower respiratory tract, and this is different from the Middle East Respiratory Syndrome coronavirus (MERS) and Severe Acute Respiratory Syndrome coronavirus diseases (Huang *et al* ,2020).

COVID-19 can provisionally be diagnosed on the basis of symptoms and confirmed using (RT-PCR) or other nucleic acid testing of infected secretions. Along with laboratory testing, chest CT scans may be helpful to diagnose COVID-19 in individuals with a high clinical suspicion of infection. Detection of a past infection is possible with serological testes (Ferrari et al ,2020).

The aim of this study is detection of the relationship of clinical features ,blood grouping for the patients with SARS-CoV-2 infection, hematological and biochemical parameter changes associated with SARS-CoV-2 infection in Misan city.

Material and methods:

The study was performed in Period between (First of November -2021 to First of May-2022), the data and blood samples were collected from 92 (55 males and 37 females) in Baby and Maternity hospital (COVID-19 center).the patients were conformed as positive for SARS-CoV-2 nucleic acid by fluoresce RT-PCR .the patients recorded in ages between (20-70 years or more) form different parts of Amara city .

Patients: ***each infected patient was subjected to the blood grouping test according to the procedure that described in kit of blood grouping from supplier in Chennai(India).***

Three drops of whole blood against Anti-A ,Anti-B and Anti-D antigen using slide method.(5 male) of peripheral venous blood was drawing from the patients with SARS-CoV-2 and divided in two samples .

The first sample (2ml) of the blood added to EDTA tube for hematological assessment ,the second blood sample (3ml) addde to the tube without anticoagulant and centrifugation for (10 minutes) at 3000 rpm , the serum was stored in (-20C˚)freezer till handled for biochemical analysis to determined   lipid profile , liver function enzymes ,kidney function tests ,blood glucose,Lactic Dyhydrogenase, Firritine value. All biochemical parameters were performed in in laboratory of Baby and Maternity hospital according to the standard methods that described in the analysis kits products in Spinach Company Spain react.

Complete blood picture (CBC) were shown from the collected blood samples by automatic methods (System X kx-21n automated hematology analyzer; JAPAIN CARE CO., LTD) including Hemoglobine (Hb), White blood cells (WBCs), Red blood cells (RBCs), Platelets ,Haematocrit or Packed cell volume (PCV) , Neutrophiles and Lymphocytes percentage .

Statistical analysis:

The results were expressed as mean ± standard error (SE). Statistical analyses were made with one-way analysis of variance (ANOVA) using SPSS 17. The criterion for statistical significance was ($P<0.05$).

The results:

The results that obtained from this study observed that the males were more infected with Covid -19 in percentage (59.7%) ,while the females were reported (40.2%) of all cases ,Fig (1).

		Males	Females
No		55	37
%		59.7	40.2
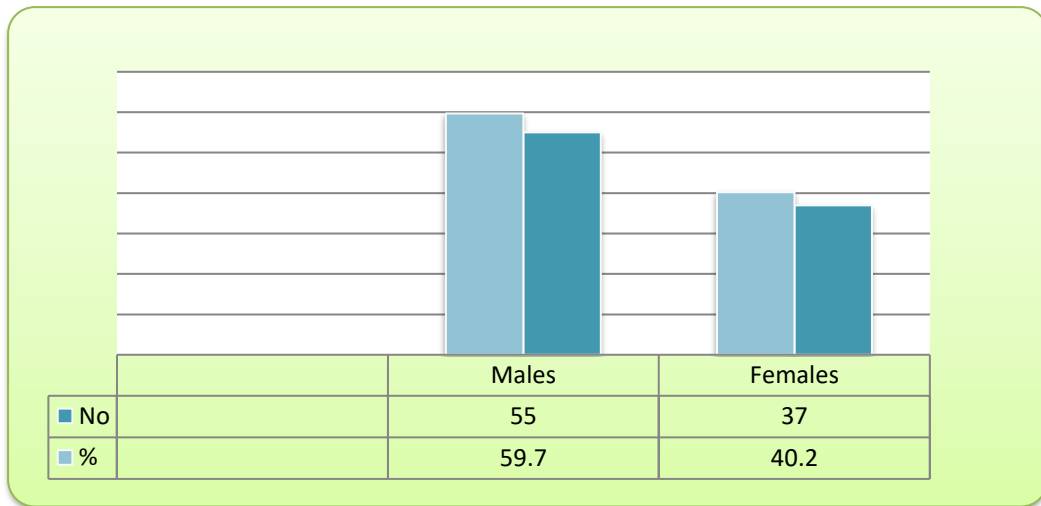
Figure(1):Show infected cases with Covid-19 according to the sex (No:93).

A high incidence of Covid-19 was reported in the ages between (51-60) years in percentage (31.5%)cases, followed by the ages between the years (61 -70 or more) in percentage (25.2%)cases ,while the low percentage of infection was reported in ages between (20 -30) years in (8.1%) cases, Fig(2).

			51-60	41-50	31-40	20-30
NO		23	29	20	11	9
%		25.2	31.5	21.7	11.9	9.7
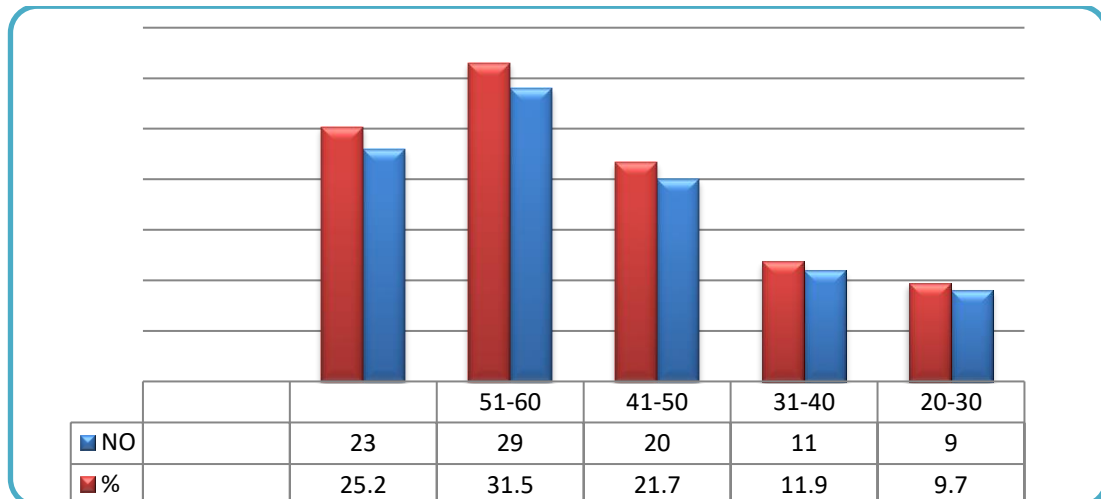
Fig (2) Show the distribution of corona virus (Covid-19) among the patients according to the different ages.

The results observed the high rate infection with Covid-19 found in blood group (A) in percentage (58.6%) , followed by blood group (O) in percentage (28.2%) ,while the low percentage fount in blood group (AB) in percentage (3.2%),Fig(3) .

ABO blood grouping

	Group AB	Group O	Group B	Group A
No	3	26	9	54
%	3.2	28.2	9.7	58.6
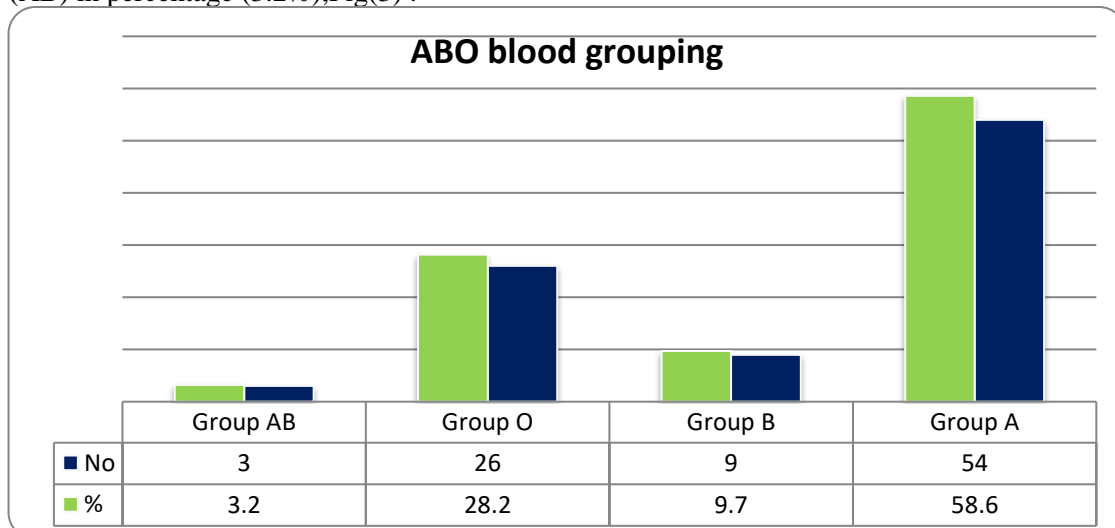
Figure(3): Show the relation of ABO blood grouping with Covid-19 infection

The results observed the most common symptoms were fever in percentage (66.3%) , cough (45.6%) , dyspenea or tachpna (21.7) ,headache or dizziness (17.4), diarrhea (17.4) and sore throat(17.3) ,Fig(4).

	Dyspnea	Diarrhea	Headache	Sorethroat	Cough	Fever
■ No	20	19	19	16	42	61
■ %	21.7	17.4	17.4	17.3	45.6	66.3
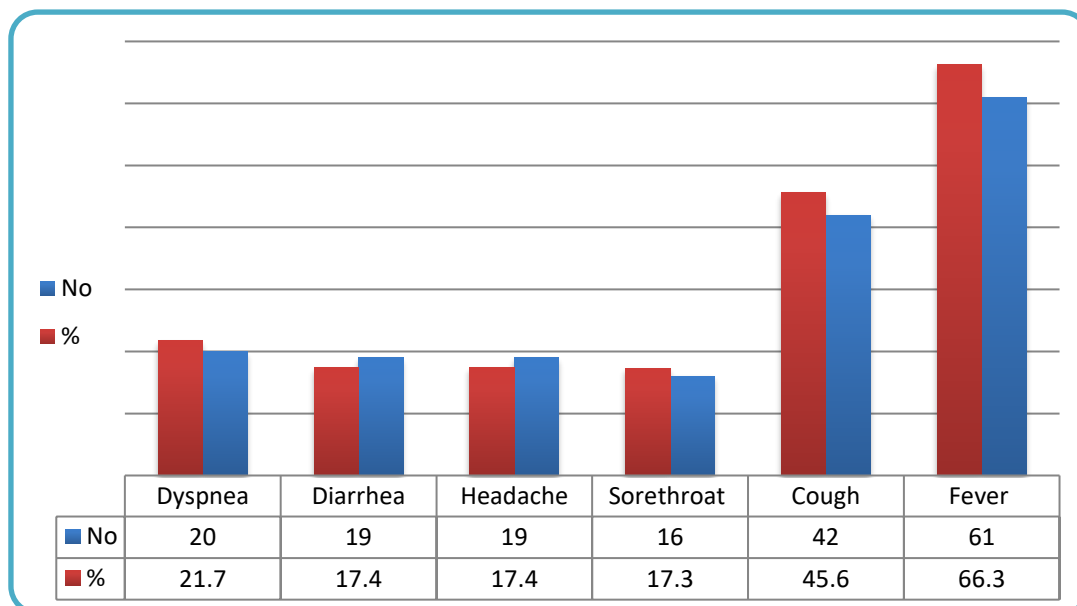
Figure(4): Show the clinical manifestations of the patients with coronavirus disease 2019(Covid-19).

The hematological analysis the blood samples collected form (92) patients infected with Covid-19 observed significant decrease in red blood cells (RBCs) as compared normal value in (p< 0.05).Also observed significant decrease in white blood cells (WBCs) and lymphocytes percentages, while the hematocrit (HCT) ,hemoglobin (Hb) ,Platelets (Plt) and neutrophiles observed significant increase as compared with normal values ,Tab(1) and Fig(5).

Table-1: the hematological parameters for the patients infected with Corona virus Covid-19 (N:92).

Parameters	Groups		
	Normal	Increase	Decrease
RBCs (100000 cells/µl)	4.99±0.35	5.97 ± 0.29	3.76 ± 0.61
HCT (%)	53.12 ± 1.93	43.83 ± 1.65	33.84 ± 1.36
HB (g/dl)	13.2± 0.55	16.6± 0.49	8.8 ± 0.65
WBCs (*10^3 Cells/mm³)	11.2 ± 0.75	16.9 ± 0.56	5.4 ± 0.13
Neutrophil %	56.14 ± 3.74	98.45 ± 3.84	43.71 ± 3.19
Lymphocytes%	24.2 ± 4.13	44.4 ± 4.69	7.19 ± 3.66
Platelets (Plt *10³/mm³)	277.6 ± 14.2	557.1 ± 22.4	123.4 ± 31.4

* WBC=White blood cells, LYM=Lymphocytes, , NEU=Neutrophils, RBC=Red blood cells, HGB=Hemoglobin, HCT=Hematocrit, PLT=Platelets. Values are expressed as means ± SD; n=92
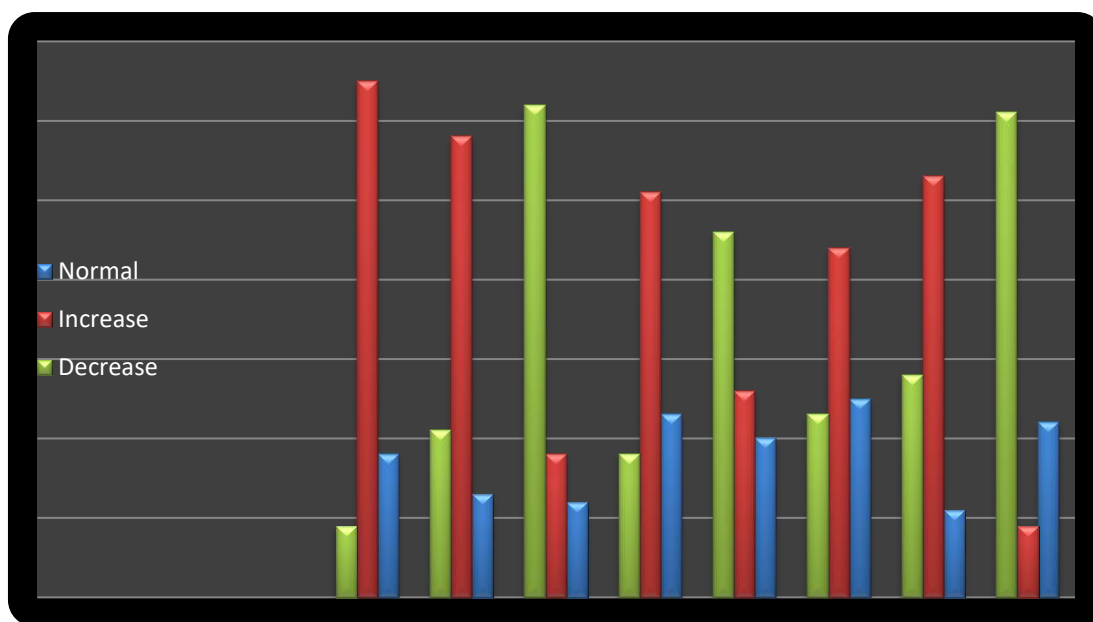
Figure(5): Show the hematological parameters for the patients infected with Corona virus Covid-19 .

Lipid profile values were detected in patients with Covid-19 included Total cholesterol ,LDL-ch, Triglyceride and vLDL-ch. Total cholesterol levels were observed significant increase in (P>0.05) after the infection and in percentage (64.1%) ,while the patients that reported normal values in percentage (28.2%) and the patients with decrease in total cholesterol found in percentage (7.6%). Also the results observed significant increase in Low-density lipoprotein (LDL) between the patients in percentage (63.04%) as compared with the patients that reported normal values in percentage (26.08%) and the patients with decrease in Low-density lipoprotein found in percentage (11.9%). Triglyceride were reported significant increase in patients infected with Covid-19 in (P>0.05) with percentage (59.7%) ,while the patients that reported normal values in percentage (34.7%) and the patients with decrease in triglyceride found in percentage (5.4%). Very Low density lipoprotein (vLDL) also reported significant increase in (P>0.05) between the patients in percentage (68.4%) as compared with the patients that reported normal values in percentage (25%) and the patients with decrease in Very Low density lipoprotein found in percentage (6.5%) ,Tab(2) and Fig(6).

Table-2: Show lipid profile parameters for the patients infected with Coivid-19 (N:92).

Parameters	Groups		
	Normal	**Increase**	**Decrease**
T.Cholestrol (mg/dl)	155.65±56.7	238.89±80.8	131.39±41.8
LDL-cholestrol(mg/dl)	142.78±36.2	184.67±42.3	138.19±28.4
Triglycerides (mg/dl)	181.22±56.33	295±103.16	143.76±32.23
vLDL-cholestrol(mg/dl)	52.68±42.2	89.63±55.8	43.75±35.5
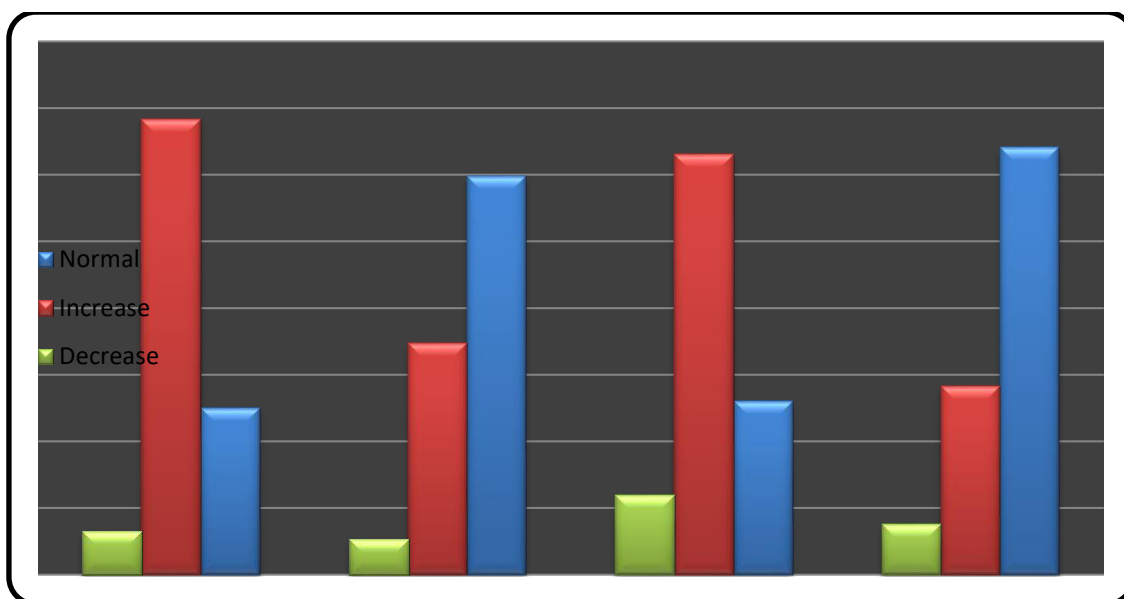
Figure(6): Showed the lipid profile parameters for the patients infected with Coivid-19 (No:92)

The biochemical analysis of the blood serum that obtained from patients with Covid-19 were observed significant increase in Alkaline phosphatase level in (P>0.05) after the infection in percentage (76.08%) ,while the patients that reported normal values in percentage (14.13%) and the patients with decrease in Alkalinephosphatase level in found in percentage (9.78%). Also the results observed significant increase in creatinine level between the patients in percentage (47.82%) as compared with the patients that reported normal values in percentage (39.13%) and the patients with decrease in creatinine found in percentage (14.04%). Liver function enzymes were reported significant increase in Aspartate aminotransferase (AST) and Alanin aminotranferase(ALT) in patients infected with Covid-19 in (P>0.05) with percentage (63.04%,52.17%) respectively ,while the patients that reported normal values in AST and ALT in percentage (11.95%, 26.60%) and the patients with decrease in AST and ALT found in percentage (5.425%,13.04%%). Blood glucose also reported significant increase in (P>0.05) in patients in percentage (57. 61%) as compared with the patients that reported normal values in percentage (27.17%) and the patients with decrease in blood glucose found in percentage (15.21%) , Also the results observed significant increase in blood urea level between the patients in percentage (66.31%) as compared with the patients that reported normal values in percentage (26.08%) and the patients with decrease in blood urea found in percentage (7.61%).

Lactic Dehydrogenase(LDH) reported significant increase in patients infected with Covid-19 in (P>0.05) with percentage (63.04%) ,while the patients that reported normal values found in percentage (23.91%) and the patients with decrease in LDH found in percentage (13.04%). The Firritin also reported significant increase in (P>0.05) between the patients in percentage (78.26%) as compared with the patients that reported normal values in percentage (19.56%) and the patients with decrease in Firritin level found in percentage (2.17%).

C-Reactive protein test observed significant increase (P>0.05) in patients with Covid-19 in percentage (84.78%) ,while the patients that reported normal values were reported in percentage (15.21%) . The blood test of D.dimer protein reported significant increase in patients infected with Covid-19 in (P>0.05) with percentage (40.21%) ,while the patients that reported normal values found in percentage (13.9104%) and the patients with decrease in D.dimer found in percentage (3.26%) ,Tab(2) and Fig(6).

Table-3: Show serum biochemical parameters for the patients infected with Covid -19 (N:30).

Parameters	Groups		
	Normal	Increase	Decrease
Alkaline phosphatase (IU/l)	94.3±8.1	154.8±3.98	34.7 ±7.51
Creatinine (mg/dl)	1.05±0.05	1.49±0.25	0.42±0.12
Alanin anino tranferase ALT (IU/l)	33.52±94	63.57±24.3	24.65±37.8
Aspartate aminotransferase AST (IU/l)	23.4 ± 45	78.9 ± 65	19.2 ± 54
Blood urea (mg/dl)	21.1±3.55	83.2±2.29	5.5 ±1.85
B. Glucose (mg/dl)	110.8 ± 5.3	372.5±8.2	67.5±8.2
Lactic Dehydrogenase LDH(U/L)	192.61±2.23	489.68±2.45	118.52±4.36
Firritine(ng/ml)	218.52±3.65	726.65±2.33	22.53±7.43
D.dimer(ng/ml)	4.22.34±2.47	6.57.12±6.23	2.78±2.29
CRP(mg/dl)	0.4±3.25	13.54±2.33	0.00

*Values are expressed as means ± SD; n=92, except the D.dimer only (52) patients were tested.
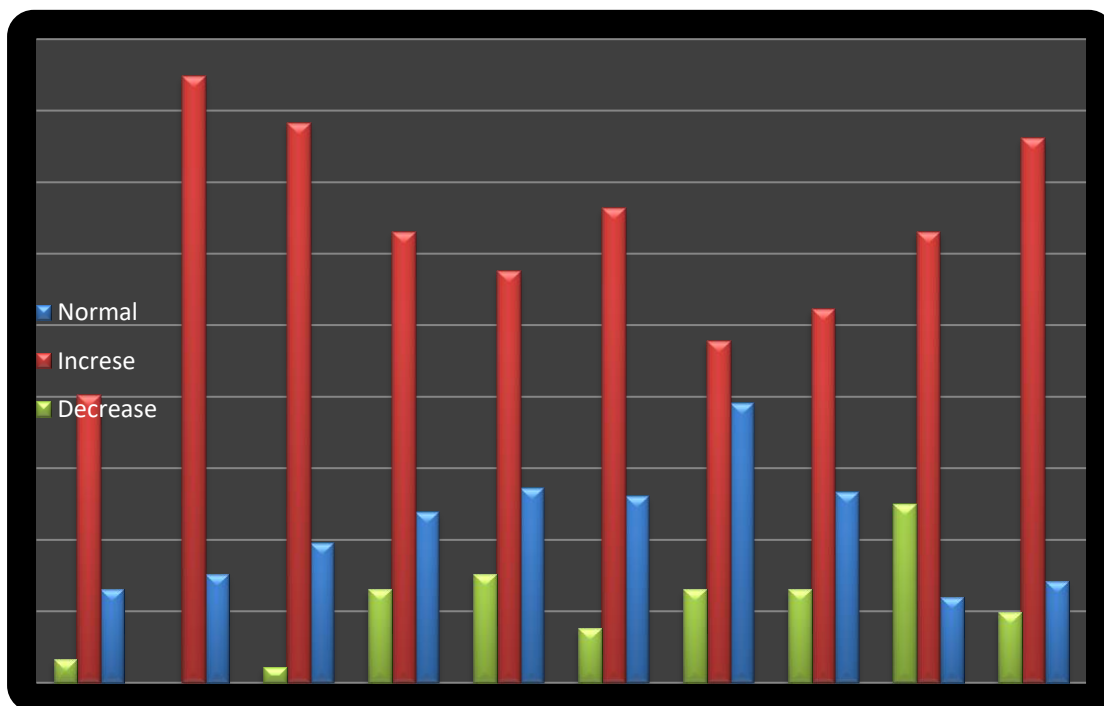
Figure(7): Showed the biochemical tests for the patients infected with Coivid-19 (No:92)

Discussion:

COVID-19 (SARS-CoV-2) spread quickly all over China and some other countries around the world, the government of China of the national health commission has established the diagnosis and treatment plan of SARS-CoV-2(Liu *et al* ,2020).

The results that obtained from this study observed that the males were more infected with COVID -19 as compared with the females, a biological attribute, and may influence an individual's susceptibility, vulnerability and exposure to infectious disease, immune function differs between sexes and has been shown to affect an individual's likelihood of acquiring infection upon exposure, or developing complications. Early research has shown that these sex differences in immune response may lead to worse COVID-19 outcomes for males in terms of ability to recover from severe infection(Ali *et al* ,2020).

Men are more likely to be employed overall and therefore more likely to be exposed, or that in such countries, men feel more entitled to seek rationed tests or are more likely to receive them, owing to entrenched cultural norms and institutionalized bias against women in health care settings. Without information on the sex ratios of those seeking or receiving tests, it is impossible to disentangle these potential mechanisms. Furthermore, globally, countries' respective GII and overall economic development are strongly correlated, and therefore the observed association could be related to countries' availability of resources in terms of testing, record-keeping and reporting (Chan *et al* ,2020).

The high incidence of COVID-19 were reported in ages between (51-60) years ,followed by the ages between (61-70 years or more). WHO(2019)reported that all ages are susceptible to COVID-19 (SARS-CoV-2) infection like any other respiratory infections such as influenza, lowering of immune system responses and previous chronic diseases like diabetes ,hypertension ,cancer ,cardiac disease increase the risk of death among the older ages after infection. In the younger ages the immune system responds rapidly to fight against invasion of the virus and successfully block sever infection, therefore the youths showed mild infection and recover faster as compared with elderly . The older people were found a higher risk of COVID-19 complications with higher rates of hospitalization, intensive care unit admissions, intubation, and death . The mechanisms through which older age may predispose to poorer prognosis have yet to be elucidated. Several hypotheses have been proposed as to why older people might be more susceptible to severe COVID-19 infection, including a weaker immune response , obesity , age-related decline in respiratory function [, frailty and multimorbidity (Xu *et al*,2020). Our findings suggest that the risk of COVID-19 mortality is higher in older adults. due to older adults being more likely to have other risk factors like poorer lung function and hypertension , these risk factors conveying a stronger risk of COVID-19 death among older people.

The high rates of infection with COVID -19 were reported in blood grouping (A), followed by blood group (O),while the low percentage reported in blood group (AB) . This results agreed with Abdulla *et al* (2020) that reported the highest rate for both male and female patients (80%), (100%) respectively were belong to blood group (A). Whereas blood groups AB shows (zero) in infected patients for both sexes. But the results un agreed with study that performed in Iran where they revealed the highest rate of patients susceptible to the infection with COVID -19 were from blood grouping (AB),these differences may be due to the biologic difference among these populations (Zhao *et al*,2020).

Wu *et al* (2020) they said "It is clear now that, these outcomes suggested that ABO antigens might have significant role in the pathogenesis of SARS-CoV-2; however, the kinetic by which these particles confer protection or susceptibility to the infection is submitted to speculation ". The most common symptoms that reported in this study were fever , cough , dyspenea or tachpna ,headache or dizziness , diarrhea and sore throat respectively. this result agreed with the results that reported by CDC (2020) and found the most common symptoms were fever, cough, dyspenea or tachpna ,headache or dizziness , diarrhea and sore throat.SARS-CoV-2, SARS-CoV, and MERS-CoV infections share many similar clinical symptoms including fever, cough, myalgia, and dyspnea. However, patients with SARS and MERS have more gastrointestinal involvement

(about one-third) than COVID-19 patients and MERS has a high incidence of renal failure, which is a typical characteristic not often found in other human coronavirus infections (Huang *et al* ,2020) .

The hematological analysis for the blood samples that obtained from the patients infected with COVI-19 observed significant decrease in red blood cells (RBCs) as compared normal value ,also observed significant decrease in white blood cells (WBCs) and lymphocytes percentages, while the haematocrit(HCT) ,hemoglobin (Hb) ,Platelets (Plt) and neutrophiles observed significant increase as compared with normal values . Red blood cells (RBCs) are the major cellular components of the blood, and is essential not only to ensure the right supply of oxygen to the tissues and the concomitant excretion of carbonic dioxide (CO_2) ,therefore any pathological alterations of RBCs disturbing their cellular function and deformability have been associated with several diseases, such as diabetes, sickle cell anemia, malaria, and some neurodegenerative (Ferrari *et al*,2020).

In the blood, SARS-CoV-2 can infects RBCs through the binding between S1 Spike protein and Band-3 protein on the erythrocyte membrane and Band-3 has already been indicated as a binding receptor for protozoan parasites, such as Plasmodium falciparum ,the link between Band-3 and the virus does not support viral replication but can affect different characteristics of the RBCs which can effect on their functions as well as the release of oxygen (Berzuni *et al* ,2021) .

Marik *et al* (2021) reported that the cell membrane RBCs may be damage after SARS-CoV-2 infection, in particular, the oxidation process of band 3 and binding with S1 spike proteins from SARS-CoV-2 and lead to significant alterations to the RBC functions, such as ATP release mechanism. In this case, hypoxia seen in severe COVID-19 cases is related to SARS-CoV-2-mediated band 3 alteration, which may decrease the ability of RBCs to release ATP, reducing vasodilatation and oxygen (O_2) delivery to tissues.

Some studies reported significant association between COVID19 infection and reduction in hemoglobin (Hb) levels. Therefore, evaluate the association between COVID-19 and the main blood parameters including the Hb concentration, WBCs, and platelet indices among COVID-19 found that Hb concentration, RBC count, HCT, MCH, and MCHC median values were all significantly decreased in COVID-19 infection (Liu *et al*,2020) .

Several studies reported lymphocytopenia as the most common finding among the COVID-19 cases. Meanwhile, other studies observed neutrophilia ,also found a significant decrease in the eosinophil count and platelet account median values among COVID-19 patients compared with controls. Thrombocytopenia is common among COVID-19 patients through inhibition of thrombopoiesis, immunological destruction of platelets, and consumption due to lung injury (Fan,2020) .

Total cholesterol observed significant increase for the patients infected with COVID-19 ,with significant increase in Low-density lipoprotein ,Triglyceride and very Low density lipoprotein. lipids play different metabolic roles as structural components, energy resources, signaling mediators, as well as roles in infections, and viral infections in particular. The effect of Corona viruses on lipid metabolism and serum lipid profile items had been observed before the current pandemic. Several studies have reported important changes in the lipid profile of patients with COVID-19 infection (Fan,2020) .

Numerous studies have observed a increase in total cholesterol, LDL-C, and apolipoprotein B and A-I levels in patients with COVID-19 infections, the increase in LDL-C was more profound the greater the severity of the disease. LDL-C and also HDL-C levels were inversely correlated with C-reactive protein (CRP) levels ,where the lower the HDL-C level due to the higher the CRP levels. Patients with low HDL-C and increase LDL-C levels at admission to the hospital were at an increased risk of developing severe disease. serum triglyceride levels were variable in patients with COVID-19 infections, also the time of when blood samples were obtained, use of medications that may affect triglyceride levels (for example glucocorticoids or propofol , or the development of disorders that effect triglyceride levels (Abdulla *et al*,2021).

The biochemical analysis for the blood serum that obtained from the patients with COVID-19 observed significant increase in Alkaline phosphatase , creatinine level , blood urea level between the patients .Liver function enzymes were reported significant increase in Aspartate aminotransferase (AST) and Alanin aminotranferase(ALT) in patients infected with COVID -19. Blood glucose ,Lactic Dehydrogenase(LDH) and Firritin also reported significant increase in the patients with COVID-19 infections .C-Reactive protein D.dimer protein also reported significant increase in patients infected with COVID -19 as compared with normal values. Moon and Baritt (2021) found elevation in the liver enzymes in 58% of all patients infected with COVID-19 ,where AST and ALT enzymes typically 1-2 time upper than the normal values may due to direct liver cell injury associated inflammatory response ,congestion and hepatic ischemia ,or related with presence of angiotensin converting enzyme 2 receptors .

The association of SARS-CoV-2 infection with renal function tests (blood Urea and serum Creatinine), the results were highly significant in regards with blood urea and significant in regards with serum creatinine levels and it was noticed that most of the patients with COVID-19 infection showed increased levels of blood urea and serum creatinine The highest rate of increased blood urea and serum creatinine levels found in female patients with COVID-19 infection, while the highest rate of infected male patients showed normal levels of blood urea and serum creatinine levels respectively(Cheng *et al*,2020).

 High levels of blood urea and serum creatinine in patients with SARS-CoV-2 infection. These results disclose, that COVID-19 may get into the peripheral blood and resides in kidney tissues because of the increased expression of ACE2 in kidney cells and then demolish the resident kidney cells . Potential inflammatory status in chronic kidney disease patients may make them susceptible to SARS-CoV-2 pneumonia due to proinflammatory status with defect in function in innate and adaptive immune cells(Boroujeni *et al*,2021) .

Lactic dehydrogenase (LDH) is an intracellular enzymes involoved an aerobic glycolysis catalyze the oxidation of pyruvate to lactate and LDH in the serum tested in various diseases .Clinically it has been reported elevated of LDH associated with poor prognosis of disease (Lippi and Plebani,2020).

In study performed by Chang *et al* (2020) were found elevation of LDH in 58.7% sensitivity and 82% specifity predicting sever COVID-19 and LDH levels resulted in 93.8% sensitivity and 88.2% specifity for predicting death of COVID-19.Therefore, elevated of LDH level is a risk factor for severity and mortality of disease.

Ferritin has a significant role in immune deregulation, particularly when their levels are high in blood, they have impact on the suppression of the immune system and on pro-inflammatory action, that take in part of the cytokine storming . Elevated serum Ferritin levels indirectly connected to acute respiratory distress syndrome and sever SARS-CoV-2 infection. This might have led to the concept of existence of secondary hemophagocytic lymphohistocytosis in SARS-CoV-2 (Abdulla *et al*,2021).

Highly significant results in regards with the relationship of D-Dimer levels with SARS-CoV-2 in which the highest rate of the infected patients showed increased levels of D-Dimer, These may be due to the majority of the patients with SARS-CoV-2 who suffers from thrombocytopenia showed increased levels of D-dimer levels leading to impaired coagulation time with fatal outcome because disseminated intravascular coagulation (Huang *et al*,2020).

Patients with COVID-19 infection may develop sepsis which considered as a major cause of disseminated intravascular coagulation. The progression of DIC happens when platelets, leukocytes, and endothelial cells are activated to induce dysregulation of formation of which happens both locally and systemically effecting the lungs of patients with severe pneumonia. The circulation of thrombin freely, without any control by natural anticoagulants, could make platelets activated and lead to fibrinolysis (Driggin *et al*,2020).

Some studies reported that C-reactive protein (CRP) level can used in early diagnosis of pneumonia and higher of CRP associated with sever pneumonia .In study that performed by Zavareh *et al* (2021) to evaluated the association between CRP and COVID-19 infection found

that the patients with CRP >64.75 mg /L were more likely to develop sever form of disease ,where the liver senthesizes significant quantities of acute phase   C-reactive protein ,these acute inflammatory protein highly sensitive for inflammation ,tissue damage and infection .

Conclusion:

SARS-CoV-2 spread quickly and the males were more infected   as compared with the females due to the men are more likely to be employed overall and therefore more likely to be exposed, high incidence of COVID-19 reported in ages between (51-60) years ,followed by the ages between (61-70 years or more) may due to a weaker immune response , obesity , age-related decline in respiratory function.

The high-rate infection with Covid-19 found in blood group (A), followed by blood group (O) may be due to the biologic difference among these populations. The hematological analysis for the patients infected with Covid-19 observed significant decrease in red blood cells (RBCs) and hemoglobin (Hb) as compared normal value, therefore the hypoxia found in severe COVID-19 cases is related to SARS-CoV-2-mediated which may decrease the ability of RBC to release ATP. Significant decrease in white blood cells (WBCs) and lymphocytes percentages, strongly associated with the severity of the disease.

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