



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

International Journal of Current Research
Vol. 13, Issue, 07, pp.18234-18238, July, 2021

DOI: <https://doi.org/10.24941/ijcr.41988.07.2021>

INTERNATIONAL JOURNAL
OF CURRENT RESEARCH

RESEARCH ARTICLE

TO STUDY COMPARISON OF VARIOUS BIOCHEMICAL PARAMETERS IN SERUM AND PLASMA

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ARTICLE INFO

Article History:

Received 20th April, 2021
Received in revised form
17th May, 2021
Accepted 14th June, 2021
Published online 30th July, 2021

Key Words:

Serum, Plasma, Coagulation.

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ABSTRACT

Background: No data is available evaluating the difference in serum versus plasma sample assay of commonly tested parameters in the biochemistry department, where the sample processing time can be significantly reduced if plasma is used for analysis instead of conventionally used serum. Hence, this study aimed comparison of various biochemical parameters in serum and plasma. **Material and method:** The comparative descriptive study was conducted in department of Biochemistry in Guru Gobind Singh Medical college and hospital, faridkot. Total 300 participants were enrolled in this study. **Result:** Mean age of study group the maximum number 23% of patients The were from the age group of 20-39 years. On the other hand, age-group 40-49 and 50-59 years were sharing 40% and 37% (respectively) of the total number of participants. Mean age was 35.46±8.5 years and range 20-59 years. Total numbers of participants enrolled in the study were 193 males and 107 were females, sharing a percentage 63% and 37% respectively The comparison of Rft/Lft and electrolytes from serum and plasma were performed on fully auto analyzer which show significant correlation ($p < 0.05$). **Conclusion:** It was concluded that good correlation is found between routine parameters analyzed in serum and plasma but mean difference between the two is significant so serum preferred for routine biochemical analysis.

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Citation: Harmanpreet Singh, Dr. Gitanjali Goyal, Jagroop Singh. 2021. "To Study Comparison of Various Biochemical Parameters in Serum and Plasma", International Journal of Current Research, 13, (07), 18234-18238.

INTRODUCTION

Human plasma and serum are commonly used matrices in biological and clinical studies^[1]. Blood plasma is a protein-rich solution in which white and red blood cells, as well as platelets, are suspended, and serum is the remaining fluid after removal of the clot from whole blood with principally the same composition as plasma with the exception that the fibrinogens and clotting factors are absent. Serum is liquid portion of the blood after it has been allowed to clot. It is free of clotting proteins but contains the clotting metabolites that result from the clotting process. Serum includes all proteins not used in blood clotting and all the electrolytes, antibodies, antigens, hormones and any exogenous substances. On the other hand plasma is liquid portion of blood that has been prevented from clotting and is more reflective of blood as it circulates in the body. Both plasma and serum are derived from whole blood that has undergone different biochemical process after blood collection. Serum is obtained from blood that has coagulated. Fibrin clot formed during coagulation, along with blood cells and related coagulation factor are separated from serum by centrifugation^[2].

The use of plasma has important advantages for laboratory professionals no need for extra time that is required for blood coagulation, shorter centrifugation duration. Reduced turnaround time to serum, 15-20% more plasma can be obtained from whole blood and risk of thrombolysis and hemolysis in plasma is lower than in serum^[3].

Anticoagulants: Anticoagulant is a substance that prevents the clotting of blood. Anticoagulants can be used endogenously or/and exogenously. The endogenous anticoagulants help prevent formation of hard clots in the blood by decreasing the ability of the blood to clump together. They are also called "blood thinners". They include medications that slow –down blood clotting time. The exogenous anticoagulants are used during analysis of blood samples. The exogenous anticoagulants are compounds that have been developed using several mechanisms of action. They include heparin, Ethylene Diamine Tetra-acetate [EDTA], fluoride oxalate etc.^[4].

Liver function tests: also referred to as a hepatic panel, are groups of blood tests that provide information about the state of a patient's liver^[5]. These tests include albumin, bilirubin (direct and indirect), and others.

The liver transaminases aspartate transaminase (AST or SGOT) and alanine transaminase (ALT or SGPT) are useful biomarkers of liver injury in a patient with some degree of intact liver function [6][7][8]. The testing is performed on a patient's blood sample. Some tests are associated with functionality (e.g., albumin), some with cellular integrity (e.g., transaminase), and some with conditions linked to the biliary tract (gamma-glutamyltransferase and alkaline phosphatase).

Renal function tests: Renal function, in nephrology, is an indication of the kidney's condition and its role in renal physiology. Renal function test are set of test performed in blood to assess the kidney damage or kidney failure. Test parameter are urea, creatinine, uric acid, electrolytes. The present study was aimed to compare and correlate various biochemical parameters in Serum and Plasma.

MATERIALS AND METHODS

The Study was conducted in Department of Biochemistry of Guru Gobind Singh Medical College and Hospital, Faridkot. Ethical clearance was taken from institutional ethical committee. Proper informed consent was taken from all the participants. Out of 300 patients, 193 were males and 107 were females.

Sampling Collection and Processing

Serum sample: Sample of the Patients for Estimation of various biochemical metabolites were taken after obtaining informed consent. At the time of Specimen collection all subjects were made to sit, relax and breathe normally for 10min. 3ml of the venous blood sample was drawn from each subject under aseptic condition. The blood sample was collected in plain or "clot activator vial" for Biochemical investigation. The specimens were transported to the Clinical Laboratory within 10 mins after samples were drawn. The blood samples were analyzed for various metabolites.

Plasma sample: Sample of the Patients for Estimation of various biochemical metabolites were taken after obtaining informed consent. At the time of Specimen collection all subjects were made to sit, relax and breathe normally for 10min. 3ml of the venous blood sample was drawn from each subject under aseptic condition. The blood sample was collected in anti-coagulated (EDTA) vial for Biochemical investigation. The specimens were transported to the Clinical Laboratory within 10 mins after samples drawn. The blood samples were analyzed for various metabolites. The total bilirubin analyzed by Diazo method, [9]. Aspartate Aminotransferase method is an adaptation of the methodology recommended by the International federation of clinical chemistry (IFCC)[10].The Alanine transaminase analyzed by Reitman & frankel method,[11] Alkaline phosphatase by Pnpp kinetic method[12], Total protein by biuret method[13], Albumin by BCG method[14], Urea by Diacetyl-monoximemethod [15],Creatinine by jaffe's method[16].Electrolytes: ion selective electrode (ISE) method.

RESULTS AND OBSERVATIONS

The study was carried Out in the Department of Biochemistry , Guru Gobind Singh Medical college, Faridkot with an objective to Study Comparison of various Biochemical

Parameters in Serum and Plasma. Out of total number of patients 300 enrolled in the study 193 were males and 107 were females, sharing a percentage 63% and 37% respectively.

Table 1. Showing age and sex distribution of Patients

Age(Years)	Male	Female	Total(N)	Percentage
20-39	40	29	69	23.0
40-49	65	55	120	40.0
50-59	88	23	111	37.0
Total	193	107	300	100.0

Showing the age distribution of patients with mean age of 35.46±8.5 years and range 20-59 years. 23% participants were sharing a age group of 20-39 being maximum in number.

On the other hand age-group 40-49 and 50-59 years were sharing 40% and 37% (respectively) of the total number of participant

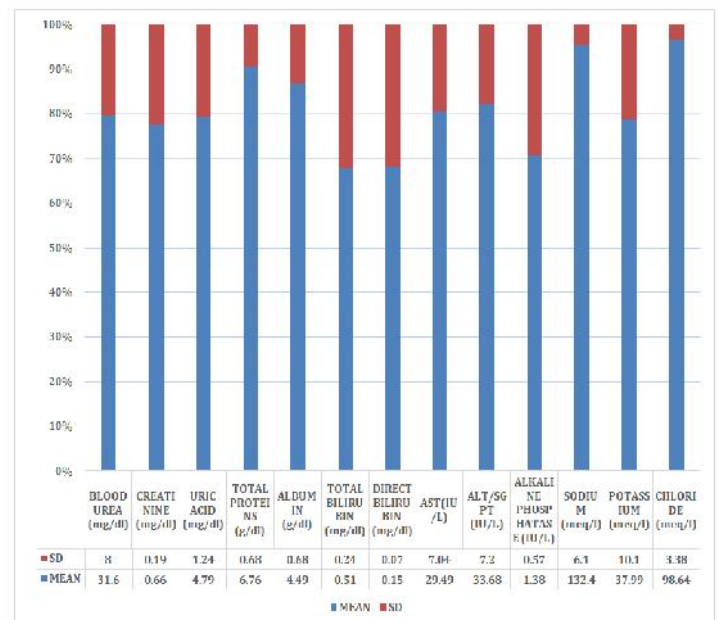


Figure 1. Mean and Standard deviation of Parameters analysed from Serum

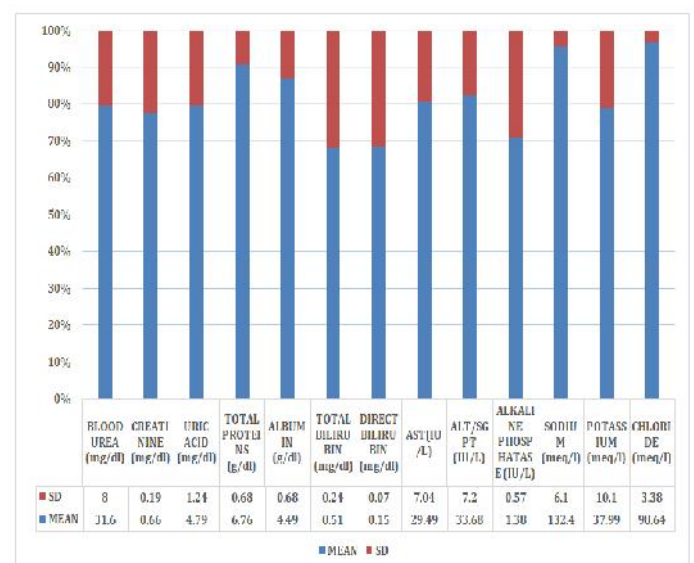


Figure 2. Mean and Standard deviation of Parameters analysed from Plasma

Table 2. Comparison and Correlation of RFT from Serum and Plasma

BLOOD UREA (mg/dl)		MEAN± SD	Comparison		Correlatoin	
			t VALUE	p VALUE	r VALUE	p VALUE
	SERUM	34.43± 8.67	4.03	<0.05	0.98	<0.0001
	PLASMA	31.6± 8.00				
SERUM CREATININE (mg/dl)	SERUM	0.74± 0.21	4.94	<0.05	0.94	<0.0001
	PLASMA	0.66 ±0.19				
URIC ACID (mg/dl)	SERUM	5.08± 1.20	2.91	<0.05	0.94	<0.0001
	PLASMA	4.79± 1.24				
TOTAL SERUM PROTEIN (g/dl)	SERUM	7.07 ±0.97	3.92	<0.05	0.95	<0.0001
	PLASMA	6.76± 0.68				
ALBUMIN (g/dl)	SERUM	4.74± 0.67	4.56	<0.05	0.90	<0.0001
	PLASMA	4.49± 0.68				

The above table inform us about the Mean ±SD, Comparison and Correlation of Renal Function Test in serum and plasma sample.

Table 3. Comparison and correlation of LFT from Serum and Plasma

TOTAL SERUM BILIRUBIN (mg/dl)		MEAN± SD	COMPARISON		CORRELATION	
			t VALUE	p VALUE	r VALUE	p VALUE
	SERUM	0.63± 0.25	6.25	<0.05	0.88	<0.0001
	PLASMA	0.51± 0.24				
DIRECT BILIRUBIN (mg/dl)	SERUM	0.28 ±0.12	15.9	<0.05	0.68	<0.0001
	PLASMA	0.15 ±0.07				
AST (IU/L)	SERUM	32.45± 7.43	4.98	<0.05	0.95	<0.0001
	PLASMA	29.49± 7.04				
ALT (IU/L)	SERUM	36.70 ±8.12	4.81	<0.05	0.89	<0.0001
	PLASMA	33.68 ±7.20				
ALP (IU/L)	SERUM	101.26 ±26.87	64.2	<0.05	----	----
	PLASMA	1.38 ±0.57				

The above table inform us about the Mean ±SD, Comparison and Correlation of Liver Function Test in serum and plasma sample

Table 4. Comparison and correlation of Electrolytes in Serum and Plasma

SODIUM		MEAN±SD	COMPARISON		CORRELATION	
			t VALUE	p VALUE	r VALUE	p VALUE
	SERUM	138.45±6.00	12.22	<0.05	0.76	<0.001
	PLASMA	132.40±6.11				
POTASSIUM	SERUM	5.44±0.89	355.8	<0.05	0.20	<0.0005
	PLASMA	37.99±10.11				
CHLORIDE	SERUM	102.93±3.95	14.26	<0.05	0.74	<0.0001
	PLASMA	98.64±3.38				

The above table inform us about the Mean ±SD, Comparison and Correlation of Electrolytes in serum and plasma sample.

DISCUSSION

Extraction of plasma is easy and less time to consume than serum. The principal advantages of heparinized plasma over serum are the reduction in specimen processing time related to not having to wait for the blood specimen to clot prior to centrifugation, reduced centrifugation time, and the avoidance of micro-clots that can obstruct sample aspiration probes in automated chemistry instruments. The wonderful thing about this plasma is that it can be stored for even 10 years from the date it has been collected. Plasma is the cell free part of the blood and it is usually treated with anticoagulants. The Present Study was carried out in the Department of Biochemistry, Guru Gobind Singh Medical College & Hospital, Faridkotto study compares various biochemical parameters in serum and plasma. mean age of study group (as shown in table 1) showed the maximum number 23% of patients The were from the age group of 20-39 years. On the other hand, age-group 40-49 and 50-59 years were sharing 40% and 37% (respectively) of the total number of participants. Mean age was 35.46±8.5 years and range 20-59 years. Total numbers of participants enrolled in the study were 193 males and 107 were females, sharing a percentage 63% and 37% respectively.

Mean value and standard deviation with range of various parameters from serum were performed on fully autoanalyzer BECKMAN COULTER AU 480. The mean value and standard deviation of Blood urea was 34.43±8.67 mg/dl with range of 18-62 mg/dl. The mean value and standard deviation of creatinine was 0.74± 0.21mg/dl with the range of 0.24-1.3mg/dl. The mean value and standard deviation of Uric Acid 5.08±1.20 mg/dl with the range of 2.8-8.1 mg/dl. The mean value and standard deviation of Total Serum Protein 7.07±0.97g/dl with the range of 4.3-9.1 g/dl. The mean value and standard deviation of Albumin 4.74±0.67g/dl with the range of 3.2-6.8 g/dl. In the present study was mean value and standard deviation with range of various parameters from plasma were performed on fully autoanalyzer. The mean value and standard deviation of Blood urea was 31.6±8.00 mg/dl with range of 16-59 mg/dl. The mean value and standard deviation of creatinine was 0.66±0.19 mg/dl with the range of 0.22-1.1 mg/dl. The mean value and standard deviation of Uric Acid 4.79±1.24mg/dl with the range of 0-8 mg/dl. The mean value and standard deviation of Total Serum Protein 6.76±0.68 g/dl with the range of 4.1 -9 g/dl. The mean value and standard deviation of Albumin 4.49±0.68g/dl with the range of 3-7.2 g/dl.

The mean value and standard deviation with range of various parameters from serum were performed on fully autoanalyzer. The mean value and standard deviation of Total Serum Bilirubin 0.63 ± 0.25 mg/dl with the range of 0.11-1.6 mg/dl. The mean value and standard deviation of direct bilirubin 0.28 ± 0.12 mg/dl with the range of 0.11-0.71 mg/dl. The mean value and standard deviation of AST 32.45 ± 7.43 IU/L with the range of 16-48 IU/L. The mean value and standard deviation of ALT 36.70 ± 8.12 IU/L with the range of 19-93 IU/L. The mean value and standard deviation of alkaline phosphatase 101.2 ± 26.87 IU/L with the range of 45-167 IU/L.

The mean value and standard deviation with range of various parameters from plasma were analyzed on fully autoanalyzer. The mean value and standard deviation of Total Serum Bilirubin 0.51 ± 0.24 mg/dl with the range of 0.12-1.5 mg/dl. The mean value and standard deviation of direct bilirubin 0.15 ± 0.07 mg/dl with the range of 0.06-0.61 mg/dl. The mean value and standard deviation of AST 29.49 ± 7.04 IU/L with the range of 12-47 IU/L. The mean value and standard deviation of ALT 33.68 ± 7.20 IU/L with the range of 18-50 IU/L. The mean value and standard deviation of Alkaline phosphatase 1.38 ± 0.57 IU/L with the range of 0-2 IU/L. In present study the mean value and standard deviation with range of various parameters from serum were performed on fully autoanalyzer. The mean value and standard deviation of Sodium 138.45 ± 5.99 meq/l with range of 112-150 meq/l. The mean value and standard deviation of Potassium 5.44 ± 0.89 meq/l with the range of 3.1-8.2. meq/l. The mean value and standard deviation of Chloride 102.93 ± 3.95 meq/l with the range of 92-130 meq/l.

The mean value and standard deviation with range of various parameters from plasma were analyzed on fully autoanalyzer.

The mean value and standard deviation of Sodium 132.40 ± 6.11 meq/l with range of 104-150 meq/l. The mean value and standard deviation of Potassium 37.99 ± 10.1 meq/l with the range of 21.4-68.4 meq/l. The mean value and standard deviation of Chloride 98.64 ± 3.38 meq/l with the range of 90-125 meq/l. The comparison of RFT from serum and plasma were performed on fully autoanalyzer which show significant correlation ($p < 0.05$). The mean value and standard deviation of RFT from serum on fully autoanalyzer of urea and creatinine is 34.43 ± 8.67 mg/dl and 0.74 ± 0.21 mg/dl respectively. The mean value and standard deviation of uric acid 5.08 ± 1.20 mg/dl. The mean value and standard deviation of RFT from plasma on fully autoanalyzer of urea and creatinine is 31.6 ± 8.00 mg/dl and 0.66 ± 0.19 mg/dl respectively. The mean value and standard deviation of uric acid from plasma is 4.79 ± 1.24 mg/dl. The comparison of LFT from serum were performed on fully autoanalyzer which show significant correlation ($p < 0.05$) for Total bilirubin, Direct bilirubin AST, ALT. The mean value and standard deviation of LFT from serum on fully autoanalyzer of total bilirubin: 0.63 ± 0.25 mg/dl, direct bilirubin: 0.28 ± 0.12 mg/dl, AST: 32.45 ± 7.43 IU/L, ALT: 36.70 ± 8.12 IU/L, ALP: 101.26 ± 26.87 IU/L. The plasma mean value and standard deviation of LFT from on fully autoanalyzer of total bilirubin: 0.51 ± 0.24 mg/dl, direct bilirubin: 0.15 ± 0.07 mg/dl, AST: 29.49 ± 7.04 IU/L, ALT: 33.68 ± 7.20 IU/L, ALP: 1.38 ± 0.57 IU/L. In present study was correlation of serum and plasma electrolytes was found to be statistically significant ($p < 0.05$). The mean value and standard deviation with range of various parameters from serum were performed on fully autoanalyzer. The mean value and standard deviation of Sodium 138.45 ± 5.99 meq/l with range of 112-150 meq/l.

The mean value and standard deviation of Potassium 5.44 ± 0.89 meq/l with the range of 3.1-8.2. meq/l. The mean value and standard deviation of Chloride 102.93 ± 3.95 meq/l with the range of 92-130 meq/l. with respect to the mean value and standard deviation of Sodium 132.40 ± 6.11 meq/l with range of 104-150 meq/l. The mean value and standard deviation of Potassium 37.99 ± 10.1 meq/l with the range of 21.4-68.4 meq/l. The mean value and standard deviation of Chloride 98.64 ± 3.38 meq/l with the range of 90-125 meq/l.

CONCLUSION

It was concluded that good correlation is found between routine parameters analyzed in serum and plasma but mean difference between the two is significant so serum preferred for routine biochemical analysis.

Acknowledgements

Words fall short to describe my deep sense of gratitude, respect and sincere thanks to my supervisor Dr. Gitanjali Goyal, Professor & Head, Department of Biochemistry, G.G.S Medical College & Hospital, Faridkot, for her expert guidance for my study. I would like to thank Mr. Jagroop Singh Sidhu Research Associate Govt. Medical College Amritsar Punjab (India).

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: The approval from the Ethical Committee of the Guru Gobind Singh Medical College and hospital, Faridkot, Punjab, India, was taken before conducting the present study.

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