**Scholars Journal of Applied Medical Sciences**
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

**Medical Laboratory Science**

# Evaluation of Haematological and Immune Status of Patients with Renal Dysfunction in Haematology and Blood Transfusion Department in a Tertiary Health Institution

Yashim N[1], Ogbe O.P[2], Obazee D.Y.[3], Dah T.Y.[4], Ajobiewe J.O.[5*], Ajobiewe H. F.[6], Ogunkoya O.F.[1], Vamparious M.T.[2], Dangana A.[7], Oyetunde B. A.[1]

[1]Department of Medical Laboratory Science Baze University Abuja Nigeria
[2]Haematology and Blood Transfusion Department National Hospital Abuja, Nigeria
[3]Medical Laboratory Services Department Nile University Teaching Hospital Abuja
[4]Department of Obstetricts and Gynaecology Federal Medical Centre Keffi, Nasarawa State of Nigeria
[5]Department of Microbiology and Parasitology National Hospital Abuja, Nigeria
[6]Department of Biological Sciences Bingham University New Karu Nasarawa State of Nigeria
[7]University of Abuja Teaching Hospital Gwagwalada Abuja, F.C.T. Nigeria

**DOI:** 10.36347/sjams.2022.v10i10.036 | **Received:** 11.09.2022 | **Accepted:** 20.10.2022 | **Published:** 29.10.2022

***Corresponding author:** Ajobiewe J.O
Department of Microbiology and Parasitology, National Hospital, Abuja, Nigeria

**Abstract** **Original Research Article**

***Background:*** Renal dysfunction is a global public health issue where steadily progressive degradation of kidney function leads to multiple haematological and immune dysfunctions that, if adequate steps are not taken to monitor them, it renders patients vulnerable to cardiovascular morbidity and mortality. This study was aimed at evaluating the haematological and immune status of patients with renal dysfunction in blood and transfusion department of the National Hospital Abuja, Nigeria. ***Methods:*** Eighty-eight participants comprising 60 renal failure patients and 28 healthy control subjects were recruited into the study between January and August 2020. Haemoglobin parameters such as total white blood cell count (WBC), haemoglobin (Hb), packed cell volume (PCV) and platelet (PLT) counts were assessed for the subjects and controls. Similarly, CD4 and CD8 counts were also determined for subjects and controls. Results were analyzed using IBM SPSS Inc., Chicago, IL, USA version 25.0 for Windows. ***Results:*** PCV, Hb, and PLTs significantly reduced in subjects (24.0815.7%, 7.9711.76 g/dl, and 150.06184.18 x109/L) compared to the control (41.312.52%, 13.7610.74 g/dl, and 252.6159.34 x109/L) whereas WBC significantly increased in case (5.7912.99 x109/L) than control (5.1811.29 x109/L), $P < 0.05$. The CD4 and CD8 count significantly decreased ($P<0.001$) in patients with renal failure (180.22169.49 cells/µL and 145.76150.87 cells/pl) compared to control (925182.62 cells/µL and 809.8195.02 cells/pl) ($P<0.05$). There was a significant difference ($P<0.001$) between anaemia grades for patients with renal failure and control. ***Conclusions:*** Renal dysfunction is significantly associated with various degrees of irregularity in haematological parameters that need proper evaluation, monitoring and treatment.

**Keywords**: Renal dysfunction, Hematological parameters, immune status.



## INTRODUCTION

The global public health issue with chronic kidney disease (CKD) is a higher burden and very high treatment costs, particularly in developing countries [1]. It has been reported to be a global public health problem, with a greater burden and very high cost of care especially in developing countries like Nigeria [2].

Renal failure is a disorder in which the kidneys cannot extract and absorb metabolism products from the blood, maintain the extracellular fluids' electrolytes, and pH balance [3]. It may be kidney dysfunction, systemic disease, and/or non-renal urological defects [2], whereas renal failure may be caused by an acute or chronic disorder [4]. The acute renal failure reflects a sudden loss in renal function necessary to increase nitrogen waste in the blood and to reduce the balance in fluid and electrolyte [3] and if the precipitating factor may be fixed for a lasting kidney injury, acute renal failure is likely to be reversible [5]. Azotaemia, the most frequent predictor of acute renal failure, is an aggregation of nitrogen waste in the blood [6]. Chronic

renal failure (CRF) is, on the other hand, a cumulative and permanent degradation of renal structures [5].

It seems that (CRF) is the primary cause of renal disease mortality as most patients with chronic renal failure advanced to the final stage and died [3]. CRF can come out of many conditions that trigger irreversible nephrotic failure like chronic pyelonephritis, diabetic and non-diabetes glomerulonephritis, hypertensive nephrosclerosis, obstructive uropathies, polycystic kidneys, medicine, and toxins [2]. In the health sector, the kidneys contribute to immune homeostasis, while immune system components mediate multiple acute kinds of kidney disease and are a key part of the development of chronic kidney disease [3]. Immune homeostasis loss in renal dysfunction leads to perpetual mobilization of immune cells and further damage to the kidney [1]. During haemodialysis (HD) the artificial cleaning method replaces important kidney functions, such as the absorption of water and metabolic waste and the reversal of the electrolyte and the acid/fundamental state [7, 8] the variations in different biochemical and haematological parameters are associated with kidney disease [2]. Anaemia refers to the degree of renal dysfunction and the key cause is a deficiency of the secretion of renal erythropoietin [7-9]. Other causes include chronic blood loss, haemolysis and depletion of bone marrow by uremic conditions [6, 9]. Erythrocyte indexes are the most affected [5, 10]. This is because the bulk of erythropoietin is produced in the juxtaglomerular apparatus, except 10 per cent in the liver and other organs [1, 6]. In addition to decreased erythropoietin, improvements in the Red Blood (RBC) index can result from deficiencies of vitamin B 12, iron and follicular acid, resulting from dietary inadequacy, blood loss or reduced erythrocyte life [5, 11]. Gastrointestinal bleeding, extreme hyperparathyroidism and systemic inflammation can also be the other causes of anaemia in CKD [5, 6].

T cell lymphopenia has been recognized for some time during renal failure [12]. Evidence indicates that global T cell lymphopenia is mainly due to increased activation-induced apoptosis and likely decreased circulating interleukin seven (IL-7) because of selective losses of circulating naïve CD4 + and CD8+T, and core memory CD4+T cells [13]. The number of naive and central memorial cells corresponds strongly to serum urea, creatinine and phosphorus levels, and suggesting deteriorating T-cell lymphopenia with increased renal dysfunction [13]. Recent findings show that cardiovascular disease (atherosclerosis, sudden heart attacks and elevated blood pressure) and T-cell fatigue or senescence is associated [12]. CD4/CD8 ratio in healthy people is usually greater than 1.04 [13]. T cell exhaustion is characterized as a lack of functionality, behaviour which affects in particular many CD8 + T-cell antiviral properties and is usually associated with cell surface expression of programmed death 1 (PD1) [14]. This study aims to evaluate the haematological parameter and the immune status in patients with renal dysfunction in Haematology and blood transfusion department in a tertiary health institution.

## METHODOLOGY

This was a cross-sectional, hospital-based study conducted at National Hospital Abuja. Consecutive patients with renal dysfunction who meet the inclusion criteria were recruited from the haematology and blood transfusion department over eight months period between January and August 2020. Sampling size was calculated from the Leslie Kish formula for the calculation of sample size in a finite population. In the sample size estimate, the prevalence of anaemia in CKD patients was 94 per cent as stated in *Obi et al*., [15].

$$n = \frac{Z^2pq}{e^2}$$

Where n = sample size, z is a standard normal deviate of alpha set at 1.96 corresponding to 95% confidence level; p = Prevalence of the prevalence of anaemia in CKD patients 94% = 0.94. e = marginal error = 5% = 0.05; q = 1-p = 1-0.94 = 0.06; n = 86.66 = 87

As per sample population, a total of 60 patients with renal failure and 28 control subjects were included in the study. Renal failure patients who were older than 18 years and gave informed consent to take part in the study were the inclusion criteria. Exclusion criteria include patients on renal replacement treatment, patients with urinary or respiratory tract infection, human hepatitis B and C deficiency, tuberculosis, hemoglobinopathy, malignancy, tobacco smoking history, use of erythropoiesis-stimulating agents, iron or blood transfusion history four-weeks before the timing of blood transfusion. Three milliliters (3m1s) of venous blood were collected aseptically using a sterile needle and syringe by a venepuncture from all the study participants into EDTA bottle for Haematological studies such as Packed cell volume (PCV), Haemoglobin (Hb), Platelet (PLT), White Cell Count (WBC) and differentials, and another 2mIs for serological analysis such as CD4 and CD8 (Cluster Differential) this was run along with the controls.

**Experimental Procedures**

Haematological parameters were analyzed using SYSMEX KX 21 N automated haematology analyzer. The blood collected in an EDA bottle was thoroughly mixed and the container stopper was opened. The tube was the set to the sample group until the buzzer sounds a two-time beep and when the LCD screen displays analyzing, the tube was removed. After that, the unit executes automatically analysis and display the request on the LCB serene. Then the unit

turns to ready status, becoming ready for analysis of the next samples. CD4 and CD8 counts were determined by FACS method. Vortex reagent pair was inverted for 5sec and then upright for 5sec. The reagent pair was opened with coring station and 20m1 blood was pipetted into each tube, cap and vortex upright for 5sec and incubate for 60 -120 min. Then, 50 vortexes were pipetted upright for 5sec and immediately before running on FASCS count instrument, the vortex was upright for 5sec It was then run on the medical (FACS count) and the reading was taken. Data analysis and inputs were carried out using program version 25.0 of the Statistical Kit for Social Sciences (IBM SPSS Inc., Chicago, IL, USA). Data is provided as frequencies, percentages and means (deviation standard). Frequencies have been compared with chi- square research. The continuous data were compared using the t-test of Student and the correlation test of Pearson was used to define the relationship of continued variables. For all experiments performed, a P-value less than 0.05 (P<0.05) was found statistically important.

## RESULTS

The study comprised 88 participants of which 60 (68.2%) were patients with renal failure and 28 (31.8%) controls. The case comprised 31 (51.7%) males and 29 (48.3%) females while control group comprised 17 (60.7%) males and 11 (39.3%) females. The majority of the patients 53 (88.3%) with renal failure were 45 years or below old. The mean age of case and control are 39±7 and 39±10 years respectively. The results of this study revealed significant decrease (P<0.001) packed cell volume, haemoglobin, and platelet in patients with renal failure (24.08±5.7%, 7.97±1.76 g/dl, and 150.06±84.18 x109/L) compared to the control (41.3±2.52%, 13.76±0.74 g/dl, and 252.6±59.34 x109/L) whereas there was a significant increase (P <0.05) in WBC in case (5.79±2.99 x109/L) as compared control (5.18±1.29 x109/L) as shown in Table 1. Table 1 also shows that CD4 significantly decreased (P<0.001) in patients with renal failure (180.22±69.49 cells/µL and CD8 145.76±50.87 cells/µL) compared to control (925±82.62 cells/µL and 809.8±95.02 cells/µL) but no significant difference was observed in CD4/CD8 ratio of both groups (P>0.05).

As shown in Table 2, there was a significant difference (P<0.001) between anaemia grading for patients with renal failure and control. While only 5.0% of patients with renal failure had mild anaemia, 55.0% and 40.0% had moderate and severe anaemia respectively. On the other hand, the majority (82.1%) of the control was normal only 17.9% had mild anaemia and no moderate or severe anaemia.

**Table 1: Haematological parameters and CD counts of patients with renal failure and control**

| Parameters | Case | Control | P-Value |
|---|---|---|---|
| PCV (%) | 24.08±5.7 | 41.3±2.52 | <0.001 |
| HB(g/dL) | 7.97±1.76 | 13.76±0.74 | <0.001 |
| WBC ($x10^9$/L) | 5.79±2.99 | 5.18±1.29 | 0.005 |
| PLT ($x10^9$/L) | 150.06±84.18 | 252.6±59.34 | <0.001 |
| CD4 cells/µL | 180.22±69.49 | 925±82.62 | <0.001 |
| CD8 cells/µL | 145.76±50.87 | 809.8±95.02 | <0.001 |
| CD4/CD8 ratio | 1.23±0.2 | 1.16±0.1 | 0.105 |

**Table 2: WHO Anaemia grading of patients with renal failure (case) and control**

| Anaemia | Group | | | | |
|---|---|---|---|---|---|
| | Case | Control | Total | $X^2$ | P-value |
| Normal (>=13.0 g/dl) | 0(0.0) | 23(82.1) | 23(26.1) | 79.357 | <0.001 |
| Mild (11.0-12.9 g/dl) | 3(5.0) | 5(17.9) | 8(9.1) | | |
| Moderate (8.0-10.9 g/dl) | 33(55.0) | 0(0.0) | 33(37.5) | | |
| Severe (<8.0 g/dl) | 24(40.0) | 0(0.0) | 24(27.3) | | |
| **Total** | **60(100.0)** | **28(100.0)** | **88(100.0)** | | |

## DISCUSSION

Investigating haematological and immune status, especially the CD4 and CD8 counts are good in determining the states of health and diseases. Renal failure is a progressive disease that has high morbidity and mortality rate [2, 16, 17], so, investigating the immune status of the patients with renal failure is essential in understanding the actual presentation and the clinical characteristics of the disease. This study reveals a significant difference in all the haematological parameters (PCV, HB, and PLT investigated between patients with renal failure and controls.

This is in line with the findings of other previous studies in Nigeria.[2, 18-22] Studies from other parts of the world have shown that haematological parameters are reduced in patients with renal failure [2, 5, 7, 23-25].

The platelet and total WBC were all within normal limits among the subjects in this study which is

in agreement with was obtained in other studies [4, 15, 21, 22, 24]. However, the raised WBC observed in the subjects may be due to inflammation and oxidative stress or be as drug reactions, toxic chemical and other diseases such as hypertension infection and diabetes as previously reported by researchers [2, 5, 26-28]. The study also found a significant reduction in haemoglobin (Hb) concentration as well as Packed Cell Volume, which may be due to low synthesis of the main stimulant of erythropoiesis in the bone marrow (serum levels of erythropoietin) [6, 7, 21, 23]. It might as well be due to another factor such as malnutrition [8-10, 21, 29] or depicting anaemia in patients with renal failure [7, 24, 25, 28].

Findings from this study showed a significant reduction in CD4 and CD8 count among subjects as compared to the control, portraying immune dysfunction in the subjects. This is similar to the findings of previous studies that have reported a significant association between reduced CD4 counts and immune dysfunction [8, 9, 26, 30, 31]. Some studies have also reported that patients with renal failure exhibit depletion of naive and central memory CD4+ and CD8+ T cells as well as reduced CD4/CD8 T cell ratio [26, 31].

This study found a high grade of anaemia among the subject group. This is in line with previous studies that have recorded common features of anaemia with various disease progressions [2, 7, 24, 25, 28]. Anaemia in patients with renal failure may also be connected with complications such as cardiac dysfunction, fatigue, mental acuity or decreased cognition [2]. These complications (especially cardiac deterioration) have been found to increase the risk of morbidity and mortality in patients with chronic renal disease [2, 3, 12]. It is therefore very important to control the severity of anaemia in these patients. This can be better achieved by proper monitoring to determine the causes and severity of the anaemia and give them prompt treatments. Such treatments include the use of erythropoietin, red blood cell (RBC) transfusion and treatment of the causal conditions.

## CONCLUSION

Renal dysfunction is a progressive disease with significantly high morbidity and mortality. This study found a significant difference in PCV, HB, WBC, PLT, CD4, and CD8 between patients with renal dysfunction and controls. It also found high grades of anaemia among the subjects. The platelet and total WBC were within normal limits among the subjects, which is similar to what was observed in other studies. We advocate proper monitoring and treatment of patients with renal dysfunction with various therapeutic options such as treatment of underlying causes, blood transfusion, and the use of erythropoietin.

## REFERENCES


1. Habib, A., Ahmad, R., & Rehman, S. (2017). Hematological changes in patients of chronic renal failure and the effect of hemodialysis on these parameters. *Int J Res Med Sci*, 5, 4998.
2. Obeagu, E. I., Obeagu, G. U., & Amilo, G. I. (2018). Haematological Changes in Patients of Chronic Kidney Disease in Umuahia, Abia State, Nigeria. *Curr Trends Biomed Eng Biosci*, 11, 001-004.
3. Al-Dulaimy, N. H., Hassan, A. J., & Ali, J. K. (2018). Assessment the immune response in patients with renal failure. *Int J Pharm Res*, 10, 475-479.
4. Tamadon, M. R. (2016). Immunity and chronic kidney disease. *Immunopathology Persa*, 2(2), e16.
5. Latiweshob, O. B., Elwerfaly, H. H., Sheriff, D. S., & Younis, M. Y. G. (2017). Haematological changes in predialyzed and hemodialyzed chronic kidney disease patients in libya. *IOSR J of Dental and Med Sciences*, *16*, 106-12.
6. Suresh, M., Mallikarjuna, R. N., Sharan, B., Singh, M., Hari Krishna, B., & Shravya, K. G. (2012). Hematological changes in chronic renal failure. *Int J Sci Res Publ*, *2*(9), 1-4.
7. Khan, M. N., & Elderdery, A. (2018). Alterations of Hematological Parameters, Hemoglobin and Hematocrit with Liver Enzymes, Aspartate Transaminase and Alanine Transaminase among Patients with Chronic Kidney Disease Undergoing Hemodialysis in Aljouf Region, Saudi Arabia. *Journal of Hematology*, *7*(1), 1-6.
8. Lisowska, K. A., Pindel, M., Pietruczuk, K., Kuźmiuk-Glembin, I., Storoniak, H., Dębska-Ślizień, A., & Witkowski, J. M. (2019). The influence of a single hemodialysis procedure on human T lymphocytes. *Scientific reports*, *9*(1), 1-9.
9. Péterle, V. B., Souza, J. D. O., Busato, F. D. O., Eutrópio, F. J., da Costa, G. D. A., Olivieri, D. N., & Tadokoro, C. E. (2018). Clinical and hematological data to group different chronic kidney disease patients: A practical approach to establish different groups of patients. *Journal of clinical laboratory analysis*, *32*(5), e22377.
10. Iyawe, I. O., & Adejumo, O. A. (2018). Hematological profile of predialysis chronic kidney disease patients in a tertiary hospital in Southern Nigeria. *Journal of Medicine in the Tropics*, *20*(1), 36.
11. Al-Rubaie, H. A., & Hasan, D. D. (2014). Assessment of hematological and biochemical parameters in hemodialysis patients and the impact of hemodialysis duration on hepcidin, ferritin and CRP. *Iraqi Journal of Hematology*, *3*(2), 85-97.
12. George, R. P., Mehta, A. K., Perez, S. D., Winterberg, P., Cheeseman, J., Johnson, B., ... & Kirk, A. D. (2017). Premature T cell senescence in pediatric CKD. *Journal of the American Society of Nephrology*, *28*(1), 359-367.

13. Winterberg, P. D., & Ford, M. L. (2017). The effect of chronic kidney disease on T cell alloimmunity. *Current opinion in organ transplantation*, *22*(1), 22-28.
14. Akbar, A. N., & Henson, S. M. (2011). Are senescence and exhaustion intertwined or unrelated processes that compromise immunity?. *Nature Reviews Immunology*, *11*(4), 289-295.
15. Obi, E., Pughikumo, O., & Oko-Jaja, R. (2017). Haematologic Profile of Patients with Chronic Kidney Disease in Port Harcourt, South-South Nigeria. *Int Blood Res Rev*, 7, 1-7.
16. Lawrence, C. U., Abiodun, O. P., Sanni, O. F., Charity, N. U., Abiodun, A. F., & Okeke, N. C. (2019). Comparative Study of Haematological Parameters in Male-Female Diabetics and Non-Diabetics in Abuja, Nigeria. *Texila Int J Acad Res*, 6, 73-80.
17. Umeji, L., Paul, A., Felix, S., Umeji, C. N., Abiola, A., Folake, O. N. C., ... & Okolo, C. S. (2019). Haematological profile of diabetes and non-diabetes patients in Abuja, Nigeria. *IJRSI*, *6*(5), 2321-2705.
18. Obeagu, E. I., Azuonwu, O., Didia, B. C., & Obeagu, G. U. (2017). Evaluation of Impact of Graves Disease on some Selected Haematological Markers among Subjects in Enugu, Nigeria. *Open Access Blood Research & Transfusion Journal*, *1*(4), 74-78.
19. Obeagu, E. I., Obeagu, G. U., Chijioke, U. O., Ofor, I. B., & Amilo, G. I. (2017). Analysis of alterations in selected haematological parameters of ascariasis patients in Umudike, Abia Stae, Nigeria. *Annals of Clinical and Laboratory Research*, *5*(3), 0-0.
20. Ifeanyi, O. E., Uzoma, O. G., Amilo, G. I., & Stella, E. I. (2017). Evaluation of Haematological Parameters in Blount, s Disease in Enugu, Nigeria. *Journal of Biotechnology Research*, *3*(9), 72-74.
21. Olasunkanmi, S. A., Olasunkanmi, S. A., Adindu, C., Sikiru, B., Mohammed, M., Mohammed, S., ... & Mohammed, A. A. (2012). HAEMATOLOGICAL PROFILE OF PATIENTS WITH CHRONIC KIDNEY DISEASE IN NIGERIA. *Journal of Nephrology and Renal transplantation*, *5*(1), 2-10.
22. George, C., Matsha, T. E., Erasmus, R. T., & Kengne, A. P. (2018). Haematological profile of chronic kidney disease in a mixed-ancestry South African population: a cross-sectional study. *BMJ open*, *8*(11), e025694. DOI: 10.1136/bmjopen-2018-025694.
23. Singh, S., & Bhatta, S. (2018). Biochemical and hematological parameters in chronic kidney disease. *Journal of Manmohan Memorial Institute of Health Sciences*, *4*(1), 4-11.
24. BEHERA, B. P. (2020). Hematological profile in patients of chronic kidney disease with its severity in a tertiary care hospital, north odisha. *Asian J Pharm Clin Res*, *13*(8), 1-6.
25. Stauffer, M. E., & Fan, T. (2014). Prevalence of anemia in chronic kidney disease in the United States. *PloS one*, *9*(1), e84943.
26. Xiang, F. F., Zhu, J. M., Cao, X. S., Shen, B., Zou, J. Z., Liu, Z. H., ... & Ding, X. Q. (2016). Lymphocyte depletion and subset alteration correlate to renal function in chronic kidney disease patients. *Renal failure*, *38*(1), 7-14.
27. Hsu, H. W., Lang, C. L., Wang, M. H., Chiang, C. K., & Lu, K. C. (2014). A review of chronic kidney disease and the immune system: a special form of immunosenescence. *Journal of Gerontology & Geriatric Research*, *3*, 1-6. DOI: 10.4172/2167-7182.1000144.
28. Pandian, J., Amitkumar, K., & Swaminathan, A. (2017). Assessment of impact of hemodialysis on hematological parameters among patients with chronic kidney disease. *Comparative Clinical Pathology*, *26*(1), 213-218.
29. Yarlagadda, D. L., Japa, P., Noorjahan, M., KSS, S. B., & Raju, S. B. (2019). Inflammatory and Humoral Immune Status in Chronic Kidney Disease. *Indian Journal of Medical Biochemistry*, *23*(2), 304-307.
30. Hutchinson, P., Chadban, S. J., Atkins, R. C., & Holdsworth, S. R. (2003). Laboratory assessment of immune function in renal transplant patients. *Nephrology dialysis transplantation*, *18*(5), 983-989.
31. Teixeira, D., Duarte, Y. A. O., Lebrão, M. L., & Bueno, V. (2013). Evaluation of renal function and immune system cells in elderly individuals from São Paulo City. *Clinics*, *68*, 39-44.