How to Cite:
Al-Khalidi, D. M. M., & Ghazzay, A. A.-. H. (2022). A hematological parameters levels study in sickle cell anemia patients in Al-Diwaniyah and Al-Najaf governorates. *International Journal of Health Sciences*, *6*(S8), 2920–2928. https://doi.org/10.53730/ijhs.v6nS8.12278

A hematological parameters levels study in sickle cell anemia patients in Al-Diwaniyah and Al-Najaf governorates

Dhafar Mohammed Manshood Al-Khalidi
University of Al-Qadisiyah, College of science, Biology department
Corresponding author email: scie.bio.mas.20.26@qu.edu.iq

Ali Abdul- Hussain Ghazzay
University of Al-Qadisiyah, College of science, Biology department
Email: ali.ghazzay@qu.edu.iq

***Abstract*---**Background: Sickle cell anemia a dangerous genetic disorder in which the erythrocytes of the body caused by a mutation in the HBB gene in the sixth position of the β chain, there is a change in the composition of hemoglobin due to the presence of sickle hemoglobin (Hbs). Aim of the study: Is to evaluate the hematological parameters levels in sickle cell anemia condition of patients with sickle cell anemia in the governorates Al- Diwaniyah and Al-Najaf Al-Ashraf. Methods: A total of one hundred and twenty-four subjects were recruited for this study which consists of eighty four sickle cell anemia subjects who (48 males and 36 females) and Forty healthy (20 male and 20 female) subjects as control who matched by age and sex of the patients groups. Conclusion: The outcomes indicated decrease in the level of RBC, Hb, MPV and HCT, while observed increased in the level of WBC, PLT, RDW-SD, RDW-CD, MCV, MCHC and PDW in sickle cell anemia patients compared with the control groups, however observed no significant in level of MCH in sickled patients compared with the control groups.

***Keywords*---**hematological parameters levels, sickle cell, anemia patients.

Introduction

Complete Blood Cell Count (CBC)

The complete blood count (CBC) is the most common test used to distinguish between different kinds of anemia. Hematological parameters, on the other hand,

will be affected by the hemoglobin mutation, with a varied alteration (Greene *et al.*, 2015). Hemolytic anemia is characterized by reduced red blood cells (RBCs), hemoglobin, and hematocrit in patients with homozygous SS and heterozygousS/βo mutations. White blood cell (WBC) and platelet counts (PLT) on the other hand, are increased and vary. The degree of anemia generated by the cells' hemolysis, sequestration, and bone marrow response to anemia are all variables that influence reticulocyte numbers. In SCA patients using hydroxyurea, the mean corpuscular volume (MCV) is frequently higher. Because of the distinct subpopulations of RBCs, SCA patients have an increased red cell distribution width (RDW), CBC is commonly used to characterize hematological parameters as useful information, however it is insufficient to provide a comprehensive picture of a patient's diagnosis (Greene *et al.*, 2015).

Methods

Subjects

The number of individuals targeted by this study was (84) individuals, who were already diagnosed as carriers of sickle cell anemia by the specialist doctor according to the clinical examination, symptoms, chromatography and blood film, who were under Follow-up in centers of Genetic blood diseases, Thalassemia patients in Al-Diwaniyah city and Al-Najaf Al-Ashraf city. The samples of the study included (48) male and (36) female and aged between (2 - 50) years and the patients individuals were divided into three groups. (40) Healthy people were randomly selected from primary health care centers that served as the control group for the study and the control group was the same age and sex for the patients.

Blood Samples

The current study period extended from the beginning of November 2021 until the end of March 2022, Blood samples were obtained from venipuncture of patients and control using a single-use syringe (5 ml). Then the blood samples were divided into groups that were 2 and 3 mL, the first group was placed in EDTA tubes of tube that prevent blood clots and used for analysis of blood parameters including CBC and genetic detection, the second group was placed in normal tubes and expelled at a speed of (3000) rpm for (10) minutes to get the serum and keep it in the freezer (-20C°) until use unless used immediately to analyze biochemical parameters such as Ferritin and Creatinine and Urea.

Study area

The samples was collected from Al-Diwaniyah Governorate, It is one of the governorates of the Middle Euphrates region. Location of the province is determined between latitudes 31.17 and 32.24, and longitudes 44.24 and 45.49 east, And Al-Najaf Governorate is one of the provinces in central Iraq, located on the edge of the western plateau of Iraq, southwest of the capital, Baghdad, Longitude 32.0259, Latitude 44.3462.

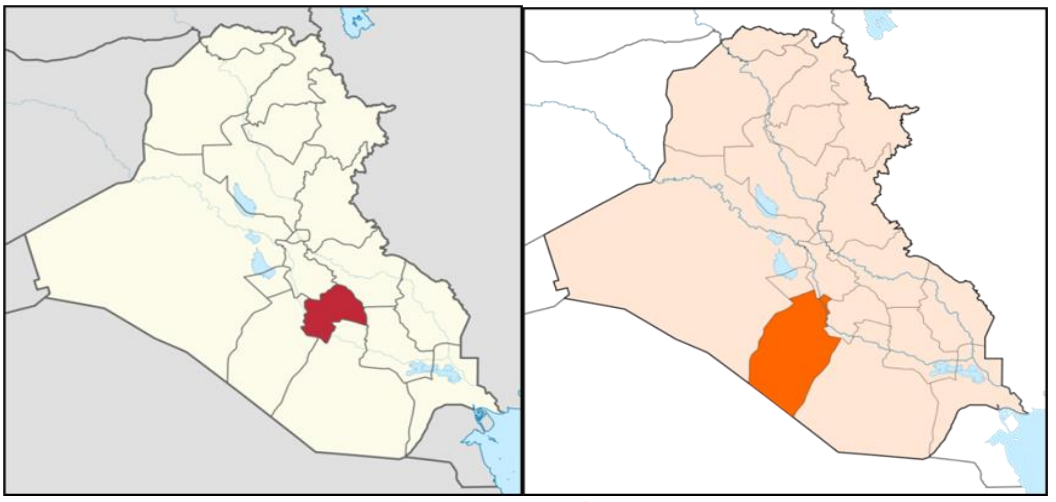

Fig (1 – 1): Study area

Blood Parameters

Complete Blood Count (CBC)

Hematological parameters are measured by a blood analyzer, where the comprehensive blood picture complete blood count (CBC) is read, which includes counting the number of Red blood cells (RBC), white blood cells(WBC), platelets(PLT), the volume of packed cells (PVC), mean cell hemoglobin (MCH) and mean corpuscular hemoglobin (MCHC) and Measurement of the hemoglobin (Hb) content of red blood cells is accomplished by photometric measurement technology according to the manufacturer's instructions.

Principles

The principle of the work of the blood analyzer is based on flow cytometric to analyze the comprehensive blood picture, during the passage of individual cells or other biological particles through a liquid stream that shines a beam of light on it. The sensors measure the chemical or physical properties of those particles or cells, as the flow allows the examination of a large number quickly from cells.

Reagents

1. Diluent- Cd32
2. Lyse-Hgb-Noc
3. Lyse-Cdwbc
4. Clean-Cd

Precedure

The samples are numbered and the name of the patient is written on it, then the blood sample that was placed in the anticoagulant tube is mixed by the mixing device, then the samples are placed in a special holder for the device, and then

the sample is placed in the place designated for withdrawing the sample in the device and we press the power key and then a microliter is withdrawn by the device through the device A thin tube to enter the blood into a special chamber in which each type of blood is isolated, and the device also counts the number of cells that pass through it by means of the sensors, and finally the result appears on the screen of the device and printed.

Results

The results of the current study reported that there is a significant decrease in the level of RBCs between sick cell anemia patients (3.47 ± 0.79) and healthy (4.82± 0.61), P-value (0.00). The results of the present study recorded that there is a significant increase in the level of WBCs between sick cell anemia patients (14.66 ± 9.03) and healthy (5.89± 1.2), P-value (0.00). The results of the current study showed that there is a significant increase in the level of MCV between sick cell anemia patients (87.21±14.1) and healthy (80.39 ± 3.9), P-value (0.005). The results of this study recorded that there was no significant difference in the level of MCH between sick cell anemia patients (27.82 ± 5.08) and healthy (26.88± 1.86), P-value (0.296). The current study showed that there was a significant increase in the level of MCHC between sick cell anemia patients (33.06 ±1.24) and healthy (31.83± 1.83), P-value (0.009).

The results of the current study demonstrated that there was a significant increase in the level of PLT between sick cell anemia patients (395.4 ± 148.6) and healthy (278.8± 49.8), P-value (0.00). The results showed too that there was a significant increase in the level of RDW-SD between sick cell anemia patients (57.36 ± 9.26) and healthy (38.91± 1.84), P-value (0.00). The results also showed that there was a significant increase in the level of RDW-CD between sick cell anemia patients (17.91 ± 3.98) and healthy (12.82± 0.78), P-value (0.00). The results of the current study showed that there was a significant decrease in the level of MPV between sick cell anemia patients (9.002 ± 0.79) and healthy (10.78± 1.21), P-value (0.00), and that there was a significant increase in the level of PDW between sick cell anemia patients (13.84 ± 3.18) and healthy (10.53± 1.94), P-value (0.00). The results of the current study reported that there was a significant decrease in the level of HCT between sick cell anemia patients (28.85 ± 6.74) and healthy (38.46± 4), P-value (0.00). The results of the current study showed that there is a significant decrease in the level of Hb between sick cell anemia patients (8.99 ± 1.4) and healthy (12.94± 1.44), P-value (0.00).

Table (1): hematological parameters levels in control and sickle cell anemia patients

Parameters	Groups	No.	Mean ± SD	P-value
RBC	Control	40	4.82± 0.61	0*
	Patients	84	3.47 ± 0.79	
WBC	Control	40	5.89± 1.2	0*
	Patients	84	14.66 ± 9.03	
MCV	Control	40	80.39±3.9	0.005*
	Patients	84	87.21 ±14.1	
MCH	Control	40	26.88± 1.86	0.296

	Patients	84	27.82 ± 5.08	
MCHC	Control	40	31.83± 1.83	0.009*
	Patients	84	33.06 ±1.24	
PLT	Control	40	278.8± 49.8	0*
	Patients	84	395.4±148.6	
RDW-SD	Control	40	38.91± 1.84	0*
	Patients	84	57.36 ± 9.26	
RDW-CD	Control	40	12.82± 0.78	0*
	Patients	84	17.91 ± 3.98	
MPV	Control	40	10.78± 1.21	0*
	Patients	84	9.002 ± 0.79	
PDW	Control	40	10.53± 1.94	0*
	Patients	84	13.84 ± 3.18	
HCT	Control	40	38.46± 4	0*
	Patients	84	28.85 ± 6.74	
HB	Control	40	12.94± 1.44	0*
	Patients	84	8.99 ± 1.4	

* Significantly difference at P<0.05; * No significantly difference at P<0.05

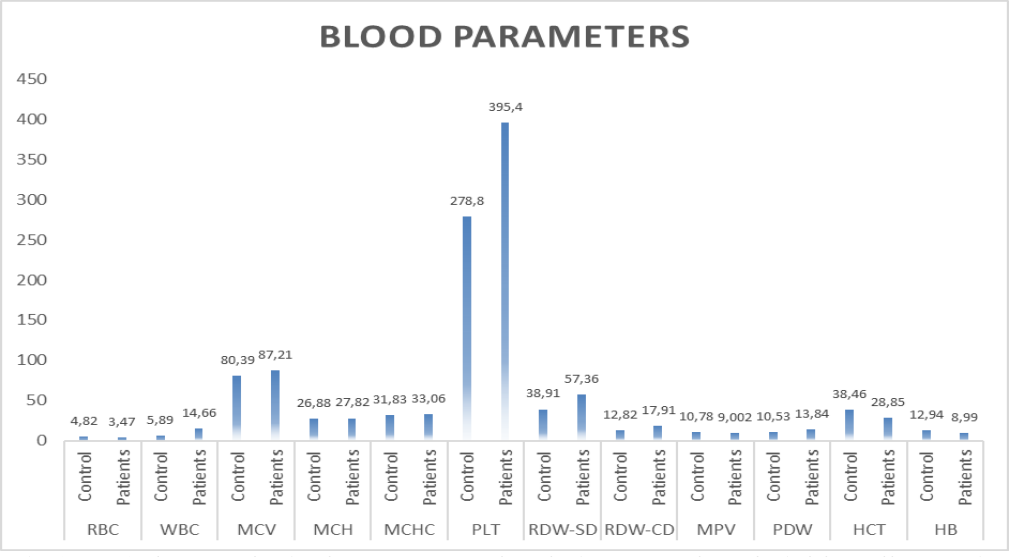

Fig (1 – 2): hematological parameters levels in control and sickle cell anemia patients

Discussion

The results of the current study showed that there is a significant decrease in the level of Hb, RBC, MPV and HCT in sickle cell anemia patients compared with control groups. That's agree with the results of the study of Aliu *et al.* (2020), Feugray *et al.* (2022), Jabbar *et al.,* (2020), Animasahun *et al.* (2011), Chikhlikar and Wilkinson.,(2014) and Iwalokun *et al.* (2011) who reported that the low hemoglobin levels the reasons for low hemoglobin in patients with sickle cell disease are attributed to nutritional insufficiency, low erythropoietin response and the most important reduced life span of RBC. Hemoglobin S (HbS)

polymerization causes sickled RBCs to become hard and non-deformable. Atypical blood rheology is brought on by RBC deformability loss, sickling, and permanent membrane damage. The red blood cell loses water, becomes dehydrated, and becomes thick due to damage to the cell membrane that permits water molecules to rush out of the cell. When there is an increase in viscosity and a high amount of hemoglobin Hbs, the red blood cells are unable to return to their usual discal posture, which leads to vaso-occlusion and other pathologies associated with SCA.

The results of the current study agree with the results of the study of Valavi *et al.*, (2010) and Sukla *et al.* (2021), who reported increase in MCV levels. On the other hand, Omoti *et al.* (2005) reported that the SCA Patients continuously hemolyze their red blood cells, with an erythrocyte survival rate of only 12 to 14 days. Consequently, the RBC, Hb, HCT and MPV are often lower than in healthy individuals, and this is fully agrees with the results of the current study.The result showed too decreased significantly of MPV of sickle cell anemia patients compared with the control group, this is agree with the study of Thavamani *et al.* (2018) who reported that the independent of HbF levels, hydroxyurea was linked to considerably decreased MPV.

The current study disagree with the study of Ufuk *et al.*, (2016) and Ridgley *et al.*, (2017) that observed increased in MPV level. Also The current study agree with study of Tshilolo *et al.,* (2010) who reported low Hb, RBC and HCT level, Its differ from the results of the study of Antwi-Boasiako *et al.* (2018) who reported increase in Hb, RBC and HCT. On the other hand, the results of the present study agree with the results of the Omoti *et al.*, (2005) who reported that this could be because with more rapid erythropoiesis, cells of different sizes and maturational stages are present. A higher MCHC might result from the release of endogenous iron from hemoglobin synthesis in destroyed red blood cells. Additionally, it's possible that a higher MCHC causes polymerization and as a result VOC. Also The current study disagree with study Chikhlikar and Wilkinson (2014)and Khan *et al.* (2010) who reported decreased in MCHC.

The present results indicated a significant increase in WBC in sickle cell anemia patients compared with control group, That's agree with the results of the study of Feugray *et al.*, (2022) and Abubakar *et al.*, (2019), who reported according to one theory, the steady-state leucocytosis in SCA is a reflection of ongoing, subclinical inflammation, which causes cytokine release and, in turn, increases leucocyte synthesis in the bone marrow or functional hypoplenia. The greater prevalence of both hidden and overt infections in younger children may be the cause of the higher mean leucocytosis associated with SCA. Leucocytosis has been proven to be a substantial risk factor for early death in SCA and related with a greater incidence of clinical stroke, which may also help to explain the increased mortality in young children with SCA. The results also agree with the results of Nnachi *et al.* (2022) and Olaniyi *et al.* (2014) who reported the increasing white blood cell count is a known pathogenic mechanism of chronic inflammation. Many studies documented that increased in WBC sickle cell anemia patients such as Harp *et al.* (2021), Ahmed *et al.,*(2017) and Akinbami *et al.* (2012), and this is fully agrees with the results of the current study.

The present results indicated a significant increase in PLT in sickle cell anemia patients compared with control group. That's agree with the results of the study of Aliu *et al.*,(2020) and Olaniyi *et al.*,(2014) who reported One-third of those with SCA had thrombocytosis, or an increased platelet count. Thrombocytosis in SCA has a number of different causes, including anemia-induced increased erythropoietin secretion, which has homology with thrombopoietin and leads to thrombopoiesis, as well as functional and/or structural asplenia, which is a feature of SCA.

On the other hand, the results of the current study agree with the results of the study of Aliyu *et al.* (2008), Antwi-Boasiako *et al.* (2018) and Akwiwu *et al.* (2020) who reported the higher platelet involvement was caused by more frequent crises and more years of life with sickle cell anemia. The results of current study are completely different from studies of Liesner *et al.* (1998) and Lard *et al.* (1999) who reported decrease in PLT levels.

References

1. Abubakar, Y., Ahmad, H. R. I., & Faruk, J. A. (2019). Hematological parameters of children with sickle cell anemia in steady and crisis states in Zaria, Nigeria. *Annals of Tropical Pathology*, *10*(2), 122.
2. Ahmed, A. E., Ali, Y. Z., Al-Suliman, A. M., Albagshi, J. M., Al Salamah, M., Elsayid, M., ... & Hamdan, A. J. (2017). The prevalence of abnormal leukocyte count, and its predisposing factors, in patients with sickle cell disease in Saudi Arabia. *Journal of blood medicine*, *8*, 185.
3. Akinbami, A., Dosunmu, A., Adediran, A., Oshinaike, O., Adebola, P., & Arogundade, O. (2012). Haematological values in homozygous sickle cell disease in steady state and haemoglobin phenotypes AA controls in Lagos, Nigeria. *BMC research notes*, *5*(1), 1-6.
4. Akwiwu, E. C., Onukak, E. E., Isong, I. K., Akpotuzor, J. O., Bassey, I. E., & Okafor, A. O. (2020). Crisis frequency and associated changes in platelet parameters among steady state sickle cell subjects. *New Zealand Journal of Medical Laboratory Science*, *74*(2), 91-94.
5. Aliu, R., Iliya, J., Quadri, O. R., Ibrahim, O. R., & Daniel, E. (2020). Haematological Profile of Children With Sickle Cell Anaemia in Steady State. *Cureus*, *12*(10).
6. Aliyu, Z. Y., Kato, G. J., Taylor IV, J., Babadoko, A., Mamman, A. I., Gordeuk, V. R., & Gladwin, M. T. (2008). Sickle cell disease and pulmonary hypertension in Africa: a global perspective and review of epidemiology, pathophysiology, and management. *American journal of hematology*, *83*(1), 63-70.
7. Animasahun, B. A., Temiye, E. O., Ogunkunle, O. O., Izuora, A. N., & Njokanma, O. F. (2011). The influence of socioeconomic status on the hemoglobin level and anthropometry of sickle cell anemia patients in steady state at the Lagos University Teaching Hospital. *Nigerian Journal of Clinical Practice*, *14*(4), 422-427.
8. Antwi-Boasiako, C., Ekem, I., Abdul-Rahman, M., Sey, F., Doku, A., Dzudzor, B., ... & Aryee, R. (2018). Hematological parameters in Ghanaian sickle cell disease patients. *Journal of blood medicine*, *9*, 203.

9. Chikhlikar, K., & Wilkinson, A. (2014). A study of red cell parameters in patients of sickle cell trait. *IOSR J Dent Med Sci*, *13*, 46-50.
10. Feugray, G., Kasonga, F., Grall, M., Benhamou, Y., Bobée-Schneider, V., Buchonnet, G., ... & Billoir, P. (2022). Assessment of Reticulocyte and Erythrocyte Parameters From Automated Blood Counts in Vaso-Occlusive Crisis on Sickle Cell Disease. *Frontiers in Medicine*, 1005.
11. Greene, D. N., Vaughn, C. P., Crews, B. O., & Agarwal, A. M. (2015). Advances in detection of hemoglobinopathies. *Clinica chimica acta*, *439*, 50-57.
12. Harp, K. O., Botchway, F., Dei-Adomakoh, Y., Wilson, M. D., Mubasher, M., Adjei, A. A., ... & Driss, A. (2021). Analysis of clinical presentation, hematological factors, self-reported bed net usage, and malaria burden in sickle cell disease patients. *EClinicalMedicine*, *39*, 101045.
13. Iwalokun, B. A., Iwalokun, S. O., Hodonu, S. O., Aina, A. O., & Agomo, P. U. (2011). Serum levels of leptin in Nigerian patients with sickle cell anaemia. *BMC Blood disorders*, *11*(1), 1-11.
14. Jabbar, E. A. K., Maktoof, A. A., & Jouda, J. (2020). Evaluation of Metal levels and Physiological parameters in Sickle cell anemia and their comparison with Iron deficiency anemia. *Research Journal of Pharmacy and Technology*, *13*(10), 4655-4660.
15. Jurado, W. C. C., Fernandez, M. C., Arauz, W. M. S., & Chilan, J. C. H. (2019). Transposition of medium and long transmission lines. *International Journal of Physical Sciences and Engineering*, *3*(1), 1–9. https://doi.org/10.29332/ijpse.v3n1.236
16. Khan, Y., Thakur, A. S., Mehta, R., Kundu, R. K., & Agnihotram, G. (2010). Hematological profile of sickle cell disease: A hospital based study at CIMS, Bilaspur, Chhattisgarh.
17. Lard, L. R., Mul, F. P. J., De Haas, M., Roos, D., & Duits, A. J. (1999). Neutrophil activation in sickle cell disease. *Journal of leukocyte biology*, *66*(3), 411-415.
18. Liesner, R., Mackie, I., Cookson, J., McDonald, S., Chitolie, A., Donohoe, S., ... & Machin, S. (1998). Prothrombotic changes in children with sickle cell disease: relationships to cerebrovascular disease and transfusion. *British journal of haematology*, *103*, 1037-1044.
19. Nnachi, O. C., Orih, M. C., Edenya, O. O., Okoye, A. E., & Ezenwenyi, I. P. (2022). Micronutrient levels and haemato-biochemical status of patients with sickle cell anaemia at a tertiary hospital in Abakaliki, south-eastern Nigeria: a cross-sectional study. *The Pan African Medical Journal*, *41*.
20. Olaniyi, J. A., Akinlade, K. S., Atere, A. D., & Arinola, O. G. (2014). Serum iron status and haematological profiles in adult Nigerian sickle cell anaemia patients. *International Journal of Tropical Disease and Health*, *4*(8), 917-927.
21. Omoti, C. E. (2005). Haematological values in sickle cell anaemia in steady state and during vaso-occlusive in Benin city, Nigeria. *Ann Afri Med*, 4(2), 62–67.
22. Sembiring, T. B., Maruf, I. R., Susilo, C. B., Hidayatulloh, A. N., & Bangkara, B. M. A. S. A. (2022). Health literacy study on approaching forest and boosting immune system strategy. *International Journal of Health Sciences*, *6*(1), 40–49. https://doi.org/10.53730/ijhs.v6n1.3145

23. Sukla, S. K., Mohanty, P. K., Patel, S., Das, K., Hiregoudar, M., Soren, U. K., & Meher, S. (2021). Iron profile of pregnant sickle cell anemia patients in Odisha, India. *Hematology, Transfusion and Cell Therapy*.
24. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. *International Journal of Health Sciences*, *6*(1), i-v. https://doi.org/10.53730/ijhs.v6n1.5949
25. Thavamani, A.; Ramanathan, R. and Puliyel, M. (2018). Mean Platelet Volume Predicts Mortality in Sickle Cell Disease. *Blood*, *132*(Suppl 1), 2383 LP – 2383.
26. Tshilolo, L., Wembonyama, S., Summa, V., & Avvisati, G. (2010). Hemogram findings in Congolese children with sickle cell disease in remission. *Medecine Tropicale: Revue du Corps de Sante Colonial*, *70*(5-6), 459-463.
27. Ufuk, Y., Hasan, Y., Murat, U., Seyfettin, C., Kerem, T., & Melih, C. (2016). Does platelet activity play a role in the pathogenesis of idiopathic ischemic priapism?. *International braz j urol*, *42*, 118-122.
28. Valavi, E., Ansari, M. J. A., & Zandian, K. (2010). How to reach rapid diagnosis in sickle cell disease?. *Iranian Journal of Pediatrics*, *20*(1), 69.