

Assessment of Some Hematological Parameters in Pulmonary Tuberculosis Patients

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Abstract

Tuberculosis can cause many types of alteration on normal marrow. Patients with tuberculosis were commonly observed to suffer hematological abnormalities. This study was conducted to investigate the influence of pulmonary tuberculosis on some hematological parameters among tertiary teaching hospital visitors. Blood samples were collected from forty (40) pulmonary tuberculosis patients and thirty healthy individuals as control. The collected blood samples were transferred to EDTA containers and CBC test was immediately carried. The measured parameters included, Hb, RBCs, ESR, HCT, MCV, MCHC, TWBCs and platelet count. The hematological analyzer (sysmexKX21N) was used. The obtained results were statistically analyzed using (SPSS) programs compared with control samples. The ESR was elevated in (99%) of the patients, 45% of ESR values exceed (100mmHg) and thrombocytosis as (17%). The mean values of patients samples were, Hb (12.1 g/dl), MCV (77.2%), RBCs (4.4), HCT (33.8), MPV (8.9) and RDW (14.5). The control samples showed mean values as, Hb (13.2g/dl), MCV (81.21%), RBCs (4.5), HCT (36.5), MCH (29.4), MCHC (36.2), WBCs (5.9), MPV(10) and RDW (13.8). The TB patients samples showed significant increase in platelets count and erythrocyte sedimentation rate in addition to clear decrease in MCV.

Keywords: Hematological abnormalities, pulmonary tuberculosis, platelet count, ESR, MCV.

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INTRODUCTION

Tuberculosis (TB) is one of the top ten causes of human death worldwide (Alamlah *et al.*, 2020). It is an infectious disease caused by *Mycobacterium tuberculosis* bacilli which mainly targets the lungs but it can affect other various parts of the body (CDC 2023). TB was classified as a significant global health threat, which affects about 1.8 million people and lead approximately to 1.25 million death (WHO TB globe report 2024). Anemia is one of the common hematological abnormalities in PTB and MDR-TB patients among whom anemia prevalence is ranging from (20% up to 94%) especially in developing countries (Y. Abanew *et al.*, 2023; M. Luo *et al.*, 2022). Higher frequency of peripheral eosinophilia was reported among patients with latent TB infection (A.C. Bohrer *et al.*, 2021).

B. Abbas, M. *et al.*, (2020) reported the observation of neutrophilia and neutropenia in both PTB and MDR-TB patients.

In addition to its recognized role in hemostasis, platelets have a significant role in chronic inflammation because platelet granules contain various mediators like chemokines, cytokines and growth factors which may be involved in lung damage (Yun *et al.*, 2016).

Patients with cavity lesions were reported to be the major source of TB bacilli infection (Shah A.R. *et al.*, 2022). Numerous pulmonary TB patients may develop chronic sequelae such as pulmonary fibrosis and pulmonary arterial hypertension (PAH) after treatment as serious complications which can severely impact life quality and survival rates (Kaushilya Kaurav *et al.*, 2024). The higher TB prevalence in some regions was suggested to be due to internal displacement of TB patients or the avoiding of TB identification and treatment as the major factors that increase the risk of severe disease spreading between the healthy people leading to rapid TB transmission among the healthy individuals because, one active TB patient can infect on average about ten (10) to fifteen (15) individuals (Datico, 2020).

According to Gebreegziabher *et al.* (2016), the haematological disorders which may greatly influence the health of TB patients include anaemia, folate insufficiency and sideroblastic illness.

The significant relationship between non-iron deficiency anaemia, TB recurrence and HIV progression may indicate the association of anaemia with unfavourable clinical outcomes for reasons other than iron deficiency, e.g. TB causes a systemic inflammatory response resulting in hepatocytes and macrophages to produce hepcidin (Gebreegziabher *et al.*, 2016).

The haematological abnormalities in TB patients were reported to be possible in both young and older females and males, but they were more frequently observed in the elderly (Minaroli ML. *et al.*, 2021).

METHODOLOGY

This work was conducted as a cross-sectional case-control study in Kosti Teaching Hospital at White Nile State of Sudan. 5ml blood were collected from forty pulmonary TB patients who were clinically positive with acid fast bacilli (MTB) in sputum with and without treatment. Similar blood samples were obtained from thirty healthy individuals as control group.

The TB patients age was ranging from 12–80 years. A systematic questionnaire was used to obtain demographic data. Each blood sample was transferred to EDTA container and complete Blood Count was performed by Sysmex (KX21N). The obtained results were statistically analyzed using the (SPSS) program.

RESULTS AND DISCUSSION

In this study (99%) of the PTB patients showed elevated ESR value with a mean of (86.2 mm/h), the ESR value exceeded (100 mm/h) in (45%) of the patients. Microcytic hypochromic anemia was observed in (42%) of the cases.

Batool *et al.*, (2022) reported raised ESR in (99%) of PTB patients with anemia frequency as (82.6%), leukocytosis (46.2%), leukopenia (20.4%) and thrombocytosis detection in (26.2%) of the patients. Microcytic hypochromic was described by Ruhini *et al.* (2023) to be common among TB infected cases reaching up to (72%). Abay *et al.* (2018) reported anemia percentage among PTB cases as (46%), with increased frequency in PTB-HIV infected cases as (60%). In this study (10%) of the PTB cases were multi drug resistant, (8%) were HIV infected and (17%) had thrombocytosis. Kallase *et al.* (2020) reported lower anemia frequency among TB patients as (25%)

Barzigary *et al.*, (2019) reported anemia prevalence as (61.53%) in TB patients where was

observed in (49.82%) cases and (20.17%) of the TB patients showed iron deficiency anemia.

In a study carried by Ayenew Behran *et al.* (2026) anemia was observed to be the common abnormality in both PTB and MDR-TB groups, with the MDR-TB patients showing higher incidence of leukopenia, neutropenia and eosinophilia (Mishra *et al.* (2018).

In this study, most of the hematological parameters showed lower mean value in PTB patients compared with the control group (Table 1). This included Hb, HCT, RBCs, MCV, MCH, MCHC and MPV. Relatively high mean values were shown by WBCs (7.2) and RDW (14.5) in PTB patients than that of control. Significantly high means were observed in platelet count (317.3 cell/cumm) and ESR (86 mm/h) whereas MCV showed significant decrease in PTB patients. This may agree with Ayenew Berhanu (2026) where, lower median of RBC, Hb, HCT, MCV, MCH and MCHC was observed in PTB patients while, the WBCs and neutrophil counts were elevated and the mono-cyte levels were significantly reduced in MDR-TB patients compared PTB cases and control. Lower Hb, PCV and blood indices values were recorded by Amar Shah *et al.*, (2022) in male and female TB patients who showed significant increase in WBCs, absolute neutrophil count, platelet count and ESR values ($P < 0.05$) compared with controls. Kaushilya *et al.*, (2024) determined the means of hematological parameters in TB patients as, Hb (12.46 g/dL), RBC (4.10) million cell/ μ L, WBC (6,598 cell/ μ L) and platelet count as (292,053 cell/ μ L) considering the WBC as an indicator of the immune system activity which reflects inflammation or infection in human bodies.

As shown by (Fig. 1), the spread of TB disease was significantly high in males (70%) when compared with the percentage of females (30%). This may indicate the influence of gender as one of the major factors which may increase the spread of TB infection among the local communities. Similar observation was reported by Rohini *et al.*, (2023), where the males represented (72%) of the TB patients compared with (28%) for females. On contrast Farzand *et al.*, (2022), described higher TB infection rate in females as (55.40%) compared with (44.60%) in males. Depending on the questionnaire answers (75%) of the TB infected patients from those who visit Kosti teaching hospital had family history of TB disease, and this indicate a high risk of TB transmission through the direct daily contact between TB patients and the healthy individuals. The historical background of TB infection among such families may be due to socioeconomic factors rather than to be genetic reasons.

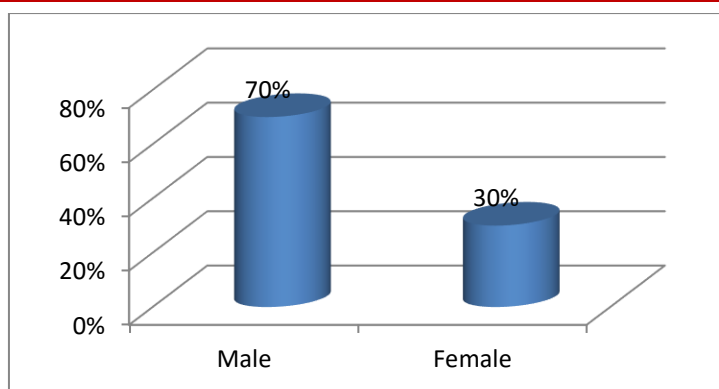


Figure 1: Shows gender among study population

Table 1: Shows the means of hematological parameters among study group (patient band control)

Parameters	TB patients	Control	Normal range
HB g/dl	12.1	13.2	13.5-16
HCT%	33.8	36.5	37-52
RBCS*10 ⁶	4.3	4.5	4.5-6
MCV fl	77.2	81.1	80-100
MCH pg	27.2	29.4	27-32
MCHC %	35.9	36.2	31-37
WBCS*10 ³	7.2	5.8	4-11
PLTS*10 ³	317.3	280.6	150-450
RDW%	14.5	13.8	11.5-15
MPV	8.9	9.9	7.4-11.5
ESR mm/h	86	13.9	0-20

CONCLUSION AND RECOMMENDATIONS

- In this study seventy five percent of the cases had family history of TB and the males to female's ratio was (2.33:1).
- Elevated ESR value was indicated in (99%) of the PTB patients.
- The hematological parameters showed clear variations of mean values between the patients and controls, with significant increase in ESR and platelet count where a significant decrease was observed in MCV.
- Microcytic hypochromic anemia was found to be common in (72%) of the cases.
- The statistical analysis showed significant positive correlation between Hb, HCT and RBCs.
- Additional research effort and medical care may require to get rid of PTB disease in the area.

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