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# Comparative Analysis of Serum Ferritin and Packed Cell Volume in Blood Donors and Non-Donors in Bayelsa State

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**ABSTRACT**

**Background and Objective:** Serum ferritin and Packed Cell Volume (PCV) are critical indicators of iron stores and overall blood health, often analyzed to assess the impact of blood donation on iron metabolism and anemia risk. This study investigates the demographic characteristics and hematological parameters of blood donors and non-donors at Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria. **Materials and Methods:** The sixty male subjects (30 donors and 30 non-donors) from the Okolobiri Region, Bayelsa State, were recruited following informed consent. Serum ferritin was analyzed using ELISA and packed cell volume was assessed via microhematocrit centrifugation. Data were analyzed using SPSS version 22, with paired t-tests determining significance at $p<0.05$. **Results:** The mean age of blood donors was 24.8±4.13 years, while non-donors had a mean age of 22.3±2.82 years. Hematological analysis revealed significant differences in packed cell volume and serum ferritin levels between the 2 groups. Non-donors exhibited higher packed cell volume (42.13±3.58) compared to donors (38.07±1.67; $p<0.05$). Similarly, serum ferritin levels were significantly elevated in non-donors (99.73±13.62) compared to blood donors (74.93±9.38: $p<0.001$). **Conclusion:** These findings indicate that regular blood donation impacts iron stores and red blood cell indices, potentially increasing the risk of subclinical anemia or iron depletion among frequent donors. This study underscores the need for proactive donor management strategies to ensure donor health and sustainability of blood donation programs. Recommendations include routine hematological monitoring, iron supplementation for frequent donors and educational campaigns to promote dietary practices that replenish iron stores post-donation. Additionally, addressing gender disparities in blood donation through awareness programs could enhance donor diversity.

**KEYWORDS**

Blood donation, hematocrit, serum ferritin, iron depletion, donor safety

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## INTRODUCTION

Blood donation is a vital public health practice that ensures a steady supply of blood for medical emergencies, surgeries and the treatment of hematological disorders. Despite its critical importance, voluntary blood donation rates remain low in many low- and middle-income countries, including Nigeria,

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where the demand for blood often surpasses the available supply[1,2]. While blood donation is generally considered safe, it is not without physiological implications. Regular donors may experience temporary reductions in hematological parameters, including hematocrit levels and serum ferritin, which reflect iron status and overall blood health[2].

In Nigeria, socio-cultural factors, gender norms and health misconceptions significantly influence blood donation behaviors. Studies have shown that males are more likely to donate blood than females due to cultural perceptions of physical fitness and eligibility[3]. However, few studies have comprehensively analyzed the hematological impact of blood donation on donors, particularly in the Niger Delta Region, where socioeconomic and environmental factors may contribute to unique health challenges.

Ferritin is an iron-binding protein that plays a crucial role in regulating iron homeostasis by storing and releasing iron. It stores iron in the ferric ($Fe^{+3}$) form and releases it in the ferrous ($Fe^{+2}$) form. Tissue ferritin is a multimeric protein composed of 24 peptide subunits, known as the light (L) and heavy (H) ferritin subunits. The H subunit possesses ferroxidase activity, converting iron from $Fe^{+2}$ to $Fe^{+3}$ for storage. Additionally, it helps regulate pH levels and increases the production of free radicals, which can cause significant damage to proteins and cellular structures[4]. The L-ferritin component contributes to the release of iron, $Fe^{+2}$, from ferritin and aids in the movement of electrons into and out of the ferritin core protein. Serum ferritin, which is mostly made up of L-ferritin subunits, is slightly glycosylated and almost entirely iron-free in contrast to tissue ferritin[5].

The proportion (%) of red blood cells in blood is known as the erythrocyte volume fraction (EVF), Packed Cell Volume (PCV) or hematocrit value. Transporting oxygen and ingested nutrients is a function of hemoglobin. More primary and secondary polycythemia is the outcome of improved transportation, which is demonstrated by greater packed cell volume. All vertebrates, except the fish family, have red blood cells that include hemoglobin, an iron-containing oxygen-transport metalloprotein[6].

This study aimed to compare the hematological parameters of blood donors and non-donors at Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State. Specifically, it evaluates serum ferritin and packed cell volume concentrations as markers of blood health and iron status. The findings will provide critical insights into the physiological effects of blood donation, informing strategies to enhance donor health and ensure a sustainable blood supply.

## MATERIALS AND METHODS

**Study area:** This study was carried out in Niger Delta University Teaching Hospital (NDUTH), Okolobiri, Bayelsa State, Nigeria. This research project was conducted from November, 2022 to September, 2023. Okolobiri town is located in the south-south part of Nigeria. It is located in Latitude 5°27°-5° and Longitude 6°55-7°85E. The climate of the area is tropical with a mean daily temperature of 29°C for most of the year. The annual rainfall in this region is between 217 and 240 cm.

**Study population:** A total number of 60 subjects comprising of 30 male donors and 30 male non-donors were recruited for the study.

### Selection criteria

**Inclusion criteria:** Donors, around the Okolobiri Region of Bayelsa State, who gave consent were included in the study.

**Exclusion criteria:** Donors with the following conditions were excluded from the study; pregnant women, HIV patients, hepatitis patients, syphilis patients and those in iron supplements.

Table 1: Demographic and characteristic blood donors and non-blood donors

| Characteristic | N | Ages (years) | Percentage | Mean±SD |
|---|---|---|---|---|
| Blood donors | 30 | 19-33 | 50 | 24.8±4.13 |
| Non-donors | 30 | 18-27 | 50 | 22.3±2.82 |

N: Number of sample

Table 2: Comparison of hematocrit value and serum ferritin between blood donors and non-blood donors (N=30)

| Parameter | Blood donors | Non-blood donors | t-value | p-value |
|---|---|---|---|---|
| Packed cell volume (%) | 38.07±1.67 | 42.13±3.58 | 3.09 | 0.008 |
| Serum ferritin (ng/mL) | 74.93±9.38 | 99.73±13.62 | 5.261 | 0.000 |

Significant at $p<0.05$, t and p: Statistical terms

**Informed consent:** Individual consent was sought for and obtained from the subjects before sample collection.

**Method of analysis:** Serum ferritin assay was analyzed using the Enzyme-Linked Immunosorbent Assay (ELISA) method and packed cell volume by microhematocrit centrifugation method.

**Statistical analysis:** Data analysis was conducted using a Statistical Package for Social Science (SPSS) version 22 window 10, the results were expressed in Mean±SD (standard deviation). Data was obtained from the analysis using paired samples t-test. Values were considered significant at $p<0.05$ and not significant at $p>0.05$.

## RESULTS

Table 1 shows the demographic and characteristics of donors and non-donors at Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State with mean age of 24.8±4.13 and 22.3±2.82, respectively. All donors and Non-donors are male.

Table 2 shows a comparison of packed cell volume and serum iron between blood donors and non-blood bonors. Packed cell volume in non-blood donors (42.133±3.58) was significantly higher than in blood donors (38.07±1.67) ($p<0.05$). Furthermore, serum ferritin in non-blood donors (99.73±13.62) was significantly higher than blood donors (74.93±9.38) ($p<0.05$).

## DISCUSSION

This study explored the demographic and hematological characteristics of blood donors and non-blood donors at Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State. The results revealed notable age differences, packed cell volume and serum ferritin levels between these groups.

The mean age of blood donors was slightly higher than that of non-donors, though this difference was not statistically analyzed. Both groups comprised only males, which is consistent with findings from studies in Nigeria and other parts of Sub-Saharan Africa where male predominance in blood donation is often attributed to sociocultural factors, eligibility requirements and physical fitness criteria[3].

Significant differences were observed in packed cell volume between the 2 groups. Non-donors had higher packed cell volume compared to blood donors. This is consistent with the physiological impact of blood donation, which can transiently reduce packed cell volume and other red blood cell indices[1]. Repeated donations can lead to subclinical anemia or iron depletion, particularly if donors do not consume adequate dietary iron or receive supplementation.

Serum ferritin levels, a marker of iron stores, were significantly lower in blood donors compared to non-donors. This finding underscores the role of regular blood donation in depleting iron stores. Chronic

iron depletion among frequent donors has been extensively documented and the results here align with those observations[2]. This emphasizes the need for monitoring iron status and providing iron supplementation for regular donors to prevent long-term health consequences.

## CONCLUSION

The study highlights significant hematological differences between blood donors and non-donors in the Niger Delta region. Blood donation is associated with reduced packed cell volume and serum ferritin levels, reflecting the physiological and nutritional demands of regular donation. These findings underscore the importance of routine monitoring and appropriate interventions to safeguard the health of donors. Regular hematological monitoring for blood donors is crucial to detect early signs of iron depletion or anemia. Iron supplementation programs should be introduced, especially in areas with high iron deficiency. Gender inclusion efforts should address socio-cultural barriers, promoting female participation. Additionally, hospitals and blood banks must implement guidelines for deferral periods based on hematological parameters to ensure donor safety.

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