AJBS Asian Journal of Biological Sciences

OPEN ACCESS

Comparison of Hematocrit Levels and Serum Transferrin Between Blood Donors and Non-Donors in a Nigerian Tertiary Hospital

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ABSTRACT

Background and Objective: Blood donation is essential for healthcare systems, but it imposes physiological demands on donors, including potential reductions in hematocrit and iron levels. This study aimed to compare hematocrit and serum transferrin levels in blood donors and non-donors at Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria. **Materials and Methods:** A cross-sectional study was conducted among 60 male participants, comprising 30 blood donors and 30 non-donors. Demographic data and hematological parameters were assessed, including hematocrit values and serum transferrin levels. Statistical comparisons between groups were conducted using independent t-tests, with significance set 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. Hematocrit levels were significantly lower in blood donors (38.07±1.67) compared to non-donors (42.13±3.58) ($t = 3.09$, $p = 0.008$). Conversely, serum transferrin levels were significantly higher in blood donors (4.22±0.57 g/L) compared to non-donors (3.27±0.66 g/L) ($t = 3.91$, $p = 0.002$). These findings indicate the physiological effects of blood donation, including reduced red blood cell concentration and compensatory increases in iron-binding proteins. **Conclusion:** Blood donation significantly affects hematological parameters, particularly hematocrit and serum transferrin levels. Monitoring donors' hematological and iron status is recommended to prevent iron deficiency and anemia. Interventions such as dietary counseling, iron supplementation and optimized donation intervals should be implemented to ensure donor health. Further research involving larger and more diverse populations is needed to generalize findings and explore the long-term impacts of frequent blood donation.

KEYWORDS

Hematocrit, serum transferrin, iron metabolism, donor health, iron deficiency anemia, hematological parameters

INTRODUCTION

Blood donation is a critical aspect of modern healthcare, serving as a lifesaving intervention for patients requiring blood transfusions due to surgery, trauma, anemia, or other medical conditions. Despite its undeniable importance, blood donation imposes physiological demands on donors, particularly with iron

ISSN: 1996-3351 (Print)
https://doi.org/10.3923/ajbs.2025.333.336

Received: 29 Nov. 2024
Accepted: 27 Dec. 2024
Published: 30 Jun. 2025

metabolism and hematological parameters. Regular blood donation can lead to transient reductions in hematocrit levels and iron stores, with potential risks such as iron deficiency and anemia in frequent donors[1]. Understanding these changes is vital for optimizing donor safety and ensuring the sustainability of blood donation programs.

Hematocrit, a measure of the proportion of red blood cells in the blood, is a crucial parameter reflecting oxygen-carrying capacity and overall hematological health. Studies have shown that blood donors often exhibit lower hematocrit levels compared to non-donors, highlighting the physiological toll of donation[2]. Serum transferrin, an iron-binding glycoprotein, plays a pivotal role in iron homeostasis, with elevated levels often observed as a compensatory mechanism in response to iron depletion caused by blood donation[3]. Monitoring these parameters is essential for identifying at-risk donors and guiding interventions to maintain their health.

In Nigeria, voluntary blood donation rates remain suboptimal despite the high demand for blood in hospitals, leading to an increased reliance on replacement donors and paid donations[4]. This underscores the importance of understanding the physiological effects of blood donation within the local context, where factors such as nutrition, health status and donation frequency may differ from global norms.

This study aimed to compare hematocrit values and serum transferrin levels between blood donors and non-donors at Niger Delta University Teaching Hospital, providing insights into the physiological impacts of blood donation and guiding strategies to enhance donor care and program sustainability.

MATERIALS AND METHODS

Study area: This research project was conducted from November 2022 to September 2023. This study was carried out at Niger Delta University Teaching Hospital (NDUTH), Okolobiri Bayelsa State, Nigeria. 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 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.

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

Method of analysis: Serum Transferrin Assay was analyzed using the Enzyme-linked Immunosorbent Assay (ELISA) method and the Hematocrit value by the 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±4.13and 22.3±2.82, respectively. All donors and non-donors are male.

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 blood donors	30	18-27	50	22.3±2.82

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

Parameter	Blood donor	Non-blood donor	t-value	p-value
Hematocrit value (%)	38.07±1.67	42.133±3.58	3.09	0.008
Serum transferrin (g/L)	4.22±0.57	3.270±0.66	3.91	0.002

Significant at p<0.05, t-value, p-value and Statistical terms

Table 2 shows comparison of hematocrit value and serum iron between blood donors and non-blood donors. Hematocrit values in non-blood donors (42.133±3.58) were significantly higher than in blood donors (38.07±1.67) (p<0.05). Furthermore, serum transferrin in non-blood donors (3.27±0.66) was significantly lower than in blood donors (4.22±0.57) (p<0.05).

DISCUSSION

The findings of this study provide significant insights into the physiological impact of blood donation on hematological and serum iron parameters. Blood donors were observed to have significantly lower hematocrit levels than non-donors, which aligns with previous studies that indicate a reduction in red blood cell concentration following blood donation[2]. This decrease in hematocrit can be attributed to the removal of red blood cells during blood donation, which may not be fully replenished before subsequent donations. Although this is typically a transient effect in healthy individuals, it underscores the need for monitoring frequent donors to prevent potential complications, such as iron deficiency anemia.

The study also found that serum transferrin levels were significantly elevated in blood donors compared to non-donors. This finding is consistent with the compensatory response of the body to iron depletion, as transferrin plays a central role in iron transport and maintaining iron homeostasis[3]. Elevated transferrin levels indicate the body's attempt to increase iron absorption and transport to meet the increased demand caused by repeated blood donations. However, prolonged iron depletion may lead to functional iron deficiency, even in donors without overt anemia, emphasizing the need for iron supplementation or dietary recommendations for regular donors[5].

The hematological differences observed between donors and non-donors in this study are significant for donor management strategies. Regular monitoring of hematocrit and serum transferrin levels is essential for identifying donors at risk of iron deficiency. Studies suggest that implementing measures such as limiting donation frequency and providing iron supplementation can help mitigate these risks[6].

This study also highlights the importance of understanding these physiological impacts within the local context. Factors such as diet, healthcare access and donation practices in Nigeria may influence the observed differences between blood donors and non-donors. For instance, studies in similar settings have shown that inadequate dietary iron intake exacerbates the risk of iron depletion in blood donors[4]. Therefore, tailored interventions that account for these local factors are necessary to optimize donor health and sustain voluntary blood donation programs in the region.

The limitations of this study include its relatively small sample size and the exclusive focus on male participants. Future research should aim to include a larger and more diverse population, including female donors, to provide a more comprehensive understanding of the impacts of blood donation. Additionally, longitudinal studies would help assess the long-term effects of repeated donations on hematological and serum iron parameters.

In conclusion, this study underscores the physiological demands of blood donation and the importance of monitoring hematocrit and iron status in donors. The findings provide a foundation for enhancing donor care and promoting safe, sustainable blood donation practices in Nigeria and similar resource-limited settings.

SIGNIFICANCE STATEMENT

This study provides critical insights into blood donation's hematological and biochemical effects, focusing on hematocrit and serum transferrin levels. The findings highlight the physiological changes experienced by blood donors compared to non-donors, particularly in iron metabolism and hematological health. The significance of this study lies in the following areas: Enhanced Understanding of Blood Donor Physiology, Improved Donor Management, Foundation for Public Health Policies and Relevance to Local Contexts. Overall, this study contributes to optimizing blood donation practices and highlights the need for targeted nutritional and clinical support for donors, ensuring the well-being of both donors and recipients.

CONCLUSION

This study highlights significant hematological and biochemical differences between blood donors and non-donors, particularly lower hematocrit levels and elevated serum transferrin in donors, reflecting the physiological impacts of blood donation. These findings emphasize the need for regular health monitoring and appropriate donor management to prevent complications such as iron deficiency anemia. Strategies such as tailored donation intervals, iron supplementation for frequent donors and promoting an iron-rich diet through awareness campaigns are essential. Further research involving diverse populations is recommended to explore the long-term effects of repeated donations and ensure donor safety.

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