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ORIGINAL ARTICLE

The Relationship between Serum Ferritin and Platelet Count in Yemeni Blood Donors

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Abstract

Background: Regular blood donation often cause iron deficiency. Changes of platelet count have been associated with iron deficiency anemia. We aimed to study the correlation between serum ferritin and platelet count in blood donors.

Methods: Full blood count was measured by Sysmex- KX-21N Haematology Analyser. Serum ferritin was examined using electrochemiluminescence technology of Cobas e 411 Analyzer.

Results: The only significant correlation between ferritin level and platelet count ($r2 = 0.432$, $p = 0.012$) demonstrated in blood donors whose serum ferritin was less than 60 ng/mL.

Conclusions: No significant association between ferritin and platelet count were found in healthy donors with ≥ or < 6 blood donations whereas the moderate positive association was found in blood donors with low ferritin concentration (< 60 ng/mL).

Keywords

Ferritin, PLTs, Blood donors

Introduction

Serum ferritin significantly declines with increasing numbers of whole blood donation. The prevalence of iron deficiency is increased with more frequent blood donation [1]. Measurement of hemoglobin level alone in blood donors may not be enough; estimation of serum ferritin may require to be examined to detect iron depletion before blood donation [2-4]. Approximately 250 mg of iron is lost with each whole blood donation. In addition, the limited iron absorption can cause iron deficiency in regular donors, particularly females [5,6]. Blood donors may have low ferritin levels, with or without anemia. Platelet counts may be affected by iron balance in blood donors [7]. Some patients with severe iron-deficiency anemia have decreased platelet count [8]. However, the association of iron deficiency with thrombocytopenia or thrombocytosis is variable among different population [9-12]. The relationship between ferritin level and platelet counts has poorly elucidated in blood donors [7]. The mechanism of thrombocytopenia development in severe IDA is not well defined, although the platelet count is improved after iron therapy, usually before increased the number of reticulocytes. Therefore, iron may be essential for platelet production [13]. The aim of the current study was to assess the possible relationship between serum ferritin and platelet count and to measure the ferritin levels in blood donors.

Subjects and Methods

This cross-sectional study was performed on 94 Yemeni male donors aged 24-41 years who donated blood at Blood Bank, Central Health Laboratories, Sana'a from February 2021 to April 2021. The eligible donors were divided into two groups depending on the number of donations. The first group included donors who had previously donated whole blood less than six times. The second group consisted of donors who donated blood six times or more. Furthermore, in relation to ferritin results, donors were divided into two groups; donors with ferritin concentration less than 60 ng/ml and those with ferritin concentration more than 60 ng/ml. The authors are accountable for all aspects of the work in ensuring that questions related

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Table 1: Demographic and hematologic parameters among first and second groups of donors.

Parameters	First group (donation < 6) (n = 50)	Second group (donation ≥ 6) (n = 44)	p-value
Age (Years)	31.7 ± 7.8	33.9 ± 7.4	0.17
BMI (Kg/m²)	24 ± 3.9	25 ± 2.5	0.07
SBP (mmHg)	119 ± 9	117 ± 19	0.41
DBP (mmHg)	77.7 ± 5.5	76 ± 6.5	0.18
Hb (g/dL)	15.1 ± 1.3	15.2 ± 1.3	0.72
RBCs (× 10^{12}/L)	5.6 ± 0.55	5.7 ± 0.62	0.32
HCT (%)	47.3 ± 2.8	47.8 ± 4.2	0.53
MCV (fL)	85.3 ± 5.3	82 ± 14	0.15
MCH (pg)	29.4 ± 2.8	28.7 ± 3.5	0.31
MCHC (g/dL)	34.3 ± 1.6	34.4 ± 2.6	0.92
RDW-CV (%)	14.7 ± 1.3	15.3 ± 2.1	0.07
WBCs (× 10^9/L)	6.8 ± 2.4	6.3 ± 2.3	0.27
PLTs (× 10^9/L)*	275 (257-295)	263 (245-288)	0.44
Ferritin (ng/mL)*	81 (65-100)	76 (62-95)	0.70

Data are presented as mean ± SD, *Data are presented as geometric mean (95% confidence interval) evaluated by Independent-Samples T test.

to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study protocol was approved by the Institutional Review Board of the Faculty of Medicine and Health Sciences, Sana'a University. Informed consent form was obtained from each eligible donor after explaining the purpose of the study.

Standard physical examinations were assessed by the blood bank staff. The donors' height and weight were measured and BMI, defined as weight (kg)/ height squared (m^2), was calculated. Blood Pressure (BP) was taken from each donor by mercury sphygmomanometer. After blood donation of 450 ml whole blood, blood samples were taken into two tubes; an EDTA tube for full blood count and a plain tube for serum ferritin analysis. The serum from each sample was separated into two Eppendorf tubes and immediately stored at -20ºC for ferritin assay. Full blood count was measured by Sysmex- KX-21N Haematology Analyser (Sysmex Corporation, Japan). Serum ferritin was examined using electrochemiluminescence technology of Cobas e 411 Analyzer (Roche Diagnostic, Germany).

Statistical Analysis

The results were analyzed by the Social Package of Social Sciences (SPSS) version 25 (SPSS Inc, Chicago, IL, USA). Ferritin and platelet count were log transformed because they were not normally distributed. Ferritin and platelet count means were subsequently transformed back and presented as geometric means and 95% confidence intervals. Independent-Samples T test was used to describe the mean differences between two groups of study. The association of ferritin with platelet count and both with other parameters were analyzed by simple linear regression in each group. The significant differences were indicated if p-value was < 0.05.

Table 2: Association of PLTs and Ferritin with demographic and hematologic parameters among first group donors.

Parameters	PLTs	Ferritin
Age	-0.086 (0.56)	-0.008 (0.96)
BMI	0.441 (***0.002***)	0.146 (0.28)
SBP	-0.134 (0.37)	-0.036 (0.81)
DBP	-0.244 (0.09)	0.030 (0.84)
Hb	-0.093 (0.53)	-0.051 (0.73)
RBCs	0.279 (0.056)	-0.009 (0.95)
HCT	0.180 (0.22)	0.066 (0.65)
MCV	-0.208 (0.16)	0.085 (0.56)
MCH	-0.271 (0.06)	0.023 (0.87)
MCHC	-0.305 (***0.036***)	-0.071 (0.62)
RDW-CV	-0.109 (0.45)	-0.228 (0.12)
WBCs	0.192 (0.19)	-0.058 (0.69)
PLTs	_____	-0.175 (0.22)

Data presented represent b values (p values) assessed by linear regression; b) Coefficient for the relationship between the dependent variables (demographic and hematologic parameters) and the independent variables (PLTs and Ferritin).

Results

The demographic and hematologic parameters of the donors was shown in Table 1. There were no significant differences between first group (donation < 6 times) and second group (donation ≥ 6 times). Association of ferritin and Platelet Count (PLTs) with demographic and hematologic parameters among the first group was revealed in Table 2. BMI was significantly associated with PLTs (r^2 = 0.441, p = 0.002). Furthermore, the

association of PLTs and ferritin with demographic and hematologic parameters was evaluated in second group donors (Table 3). There were no significant association between PLTs and ferritin and other parameters.

PLTs was significantly associated with ferritin level (r^2 = 0.432, p = 0.012) in blood donors whose ferritin concentrations were less than 60 ng/mL (Table 4). Also, Diastolic Blood Pressure (DBP) was significantly associated with ferritin (r^2 = 0.585, p = 0.002). In contrast, there was no significant association between PLTs and ferritin and other dependent variables in blood donors with ferritin levels more than 60 ng/mL (Table 5).

Table 3: Association of PLTs and Ferritin with demographic and hematologic parameters among second group donors.

Parameters	PLTs	Ferritin
Age	0.189 (0.246)	-0.055 (0.73)
BMI	0.201 (0.21)	-0.193 (0.23)
SBP	-0.296 (0.07)	0.074 (0.64)
DBP	-0.106 (0.52)	0.095 (0.56)
Hb	-0.259 (0.09)	0.302 (0.056)
RBCs	-0.059 (0.72)	0.067 (0.68)
HCT	-0.234 (0.15)	0.140 (0.38)
MCV	-0.138 (0.39)	0.231 (0.15)
MCH	-0.044 (0.79)	-0.024 (0.88)
MCHC	0.057 (0.73)	-0.099 (0.55)
RDW-CV	-0.095 (0.56)	-0.089 (0.58)
WBCs	-0.095 (0.55)	0.235 (0.15)
PLTs	_____	0.290 (0.056)

Data presented represent b values (p values) assessed by linear regression; b) Coefficient for the relationship between the dependent variables (demographic and hematologic parameters) and the independent variables (PLTs and Ferritin).

Table 4: Association of PLTs and Ferritin with demographic and hematologic parameters among donors who have ferritin level less than 60 ng/mL (n = 33).

Parameters	PLTs	Ferritin
Age	-0.093 (0.64)	0.279 (0.16)
BMI	0.061 (0.77)	-0.067 (0.74)
SBP	-0.221 (0.27)	0.113 (0.57)
DBP	-0.356 (0.045)	0.585 (***0.002***)
Hb	0.012 (0.95)	-0.112 (0.58)
RBCs	-0.102 (0.62)	0.096 (0.64)
HCT	-0.170 (0.40)	0.029 (0.88)
MCV	-0.061 (0.77)	0.048 (0.81)
MCH	-0.020 (0.92)	-0.112 (0.58)
MCHC	-0.036 (0.86)	-0.156 (0.44)
RDW-CV	-0.211 (0.30)	0.065 (0.75)
WBCs	0.170 (0.40)	0.002 (0.99)
PLTs	_____	0.432 (***0.012***)

Data presented represent b values (p values) assessed by linear regression; b) Coefficient for the relationship between the dependent variables (demographic and hematologic parameters) and the independent variables (PLTs and Ferritin).

Discussion

The exact mechanism of changes in platelet count with iron deficiency is not well understood. It may be explained by the alteration of the activity of iron dependent enzymes during thrombopoiesis [14]. Our study evaluated the relationship between ferritin level and platelet count in blood donors. We found no significant change in serum ferritin between blood donors who donated blood 6 times or more and those with blood donation less than 6 times. Also, in first group (donation < 6 times), BMI was significantly associated with platelet count. Previous studies revealed that elevated platelet count is associated with increased BMI due to chronic inflammation [15,16]. In the same line, Jeong, et al. found that hematological parameters such as PLTs, RBCs, WBCs, Hb and HCT increased with elevated BMI in children and adults [17].

Our study exhibited no significant relationship between ferritin level and platelet count in both blood donor groups, and this can be explained by no iron deficiency in the donors regarding to the results of serum ferritin. Our study donors donated whole blood less than 30 times. Relative "iron depletion" typically occurs when serum ferritin is 22-40 mg/dL [18,19]. According to Prinsze, et al., ferritin level significantly decreased in blood donors with whole blood donation > 50 times as compared with donors with less than 10 donations [20]. Serum ferritin measurement is the most reliable initial test for iron deficiency anemia [21] and its levels in healthy blood donors are less altered by inflammation and provide a good indication of iron

Table 5: Association of PLTs and Ferritin with demographic and hematologic parameters among donors who have ferritin level more than 60 ng/mL (n = 61).

Parameters	PLTs	Ferritin
Age	0.018 (0.89)	-0.044 (0.74)
BMI	0.445 (***0.0004***)	0.020 (0.87)
SBP	-0.236 (0.07)	-0.002 (0.99)
DBP	-0.161 (0.22)	0.056 (0.67)
Hb	-0.198 (0.13)	-0.028 (0.83)
RBCs	0.229 (0.08)	0.062 (0.63)
HCT	0.015 (0.91)	-0.002 (0.99)
MCV	-0.216 (0.10)	-0.058 (0.66)
MCH	-0.209 (0.12)	-0.052 (0.69)
MCHC	-0.107 (0.42)	-0.079 (0.56)
RDW-CV	-0.074 (0.58)	-0.112 (0.40)
WBCs	0.022 (0.87)	-0.057 (0.67)
PLTs	_____	-0.167 (0.20)

Data presented represent b values (p values) assessed by linear regression; b) Coefficient for the relationship between the dependent variables (demographic and hematologic parameters) and the independent variables (PLTs and Ferritin).

status [22]. However, a number of studies demonstrated no significant correlation between serum ferritin and platelet count in patients with IDA [10-12]. Similarly, an earlier report showed transferrin and transferrin saturation, not ferritin, are significant correlated with platelet counts among blood donors [7].

On the other hand, we found moderate positive correlation (r^2 = 0.432, p = 0.012) between serum ferritin and platelet count in blood donors with ferritin concentration less than 60 ng/mL. We are in disagreement with the large retrospective study reporting no relationship between low ferritin level and platelet count in blood donors with or without IDA [23]. Moreover, ferritin level was positively associated with Diastolic Blood Pressure (DBP) in the donors with serum ferritin less than 60 ng/mL. Previous studies found positive correlation between serum ferritin, diastolic blood pressure and other components of metabolic syndrome [24-26]. Oshaug, et al. have reported that DBP was a predictor for ferritin level [27]. Limitations of our study is the small sample size and the inclusion of only eligible blood donors. Further studies in donors with IDA are warranted.

Conclusion

In conclusion, serum ferritin was positively associated with platelet count in blood donors with low ferritin levels (< 60 ng/mL). No such correlations were found in donors with ≥ or < 6 blood donations.

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Author Contributions

(I) Conception and design: Boshra Al-Absi

(II) Administrative support: Mohammed Abdul Wahid Almorish

(III) Provision of study materials or patients: Boshra Al-Absi and Mohammed Abdul Wahid Almorish

(IV) Collection and assembly of data: Mohammed Abdul Wahid Almorish

(V) Data analysis and interpretation: Boshra Al-Absi

(VI) Manuscript writing: Boshra Al-Absi and Mohammed Abdul Wahid Almorish

(VII) Final approval of manuscript: Boshra Al-Absi and Mohammed Abdul Wahid Almorish

Disclosure

All authors have no conflicts of interest to declare.

References

1. Skikne B, Lynch S, Borek D, Cook J (1984) 14 Iron and blood donation. Clin Haematol 13: 271-287.
2. Mittal R, Marwaha N, Basu S, Mohan H, Kumar AR (2006) Evaluation of iron stores in blood donors by serum ferritin. Indian J Med Res 124: 641-646.
3. Duggan F, O'Sullivan K, Power JP, Healy M, Murphy WG (2016) Serum ferritin in plateletpheresis and whole blood donors. Transfus Apher Sci 55: 159-163.
4. Naidoo E, O'Broin S, Tong E, McSweeney E, Murphy C, et al. (2010) High prevalence of iron deficiency in non-anaemic first time female blood donors. Vox Sanguinis 99: 187-188.
5. Kiss JE, Birch RJ, Steele WR, Wright DJ, Cable RG (2017) Quantification of body iron and iron absorption in the REDS-II D onor I ron S tatus Evaluation (RISE) study. Transfusion 57: 1656-1664.
6. Cable RG, Brambilla D, Glynn SA, Kleinman S, Mast AE, et al. (2016) Effect of iron supplementation on iron stores and total body iron after whole blood donation. Transfusion 56: 2005-2012.
7. Eder AF, Yau YY, West K (2017) The effect of iron balance on platelet counts in blood donors. Transfusion 57: 304-312.
8. Cunha V, Ferreira M, Barosa R, Fonseca AG, Delerue F, et al. (2015) Iron-induced thrombocytopenia in severe iron-deficiency anemia. Expert Rev Hematol 8: 247-251.
9. Dincol K, Aksoy M (1969) On the platelet levels in chronic iron deficiency anemia. Acta Haematologica 41: 135-143.
10. Kuku I, Kaya E, Yologlu S, Gokdeniz R, Baydin A (2009) Platelet counts in adults with iron deficiency anemia. Platelets 20: 401-405.
11. Kadikoylu G, Yavasoglu I, Bolaman Z, Senturk T (2006) Platelet parameters in women with iron deficiency anemia. J Natl Med Assoc 98: 398.
12. Park M-J, Park P-W, Seo Y-H, Kim K-H, Park S-H, et al. (2013) The relationship between iron parameters and platelet parameters in women with iron deficiency anemia and thrombocytosis. Platelets 24: 348-351.
13. Morgan E (1981) Transferrin, biochemistry, physiology and clinical significance. Molecular Aspects of Medicine 4: 1-123.
14. Ganti AK, Shonka NA, Haire WD (2007) Pancytopenia due to iron deficiency worsened by iron infusin: A case report. Journal of Medical Case Reports 1: 1-3.
15. Samocha-Bonet D, Justo D, Rogowski O, Saar N, Abu-Abeid S, et al. (2008) Platelet counts and platelet activation markers in obese subjects. Mediators Inflamm 2008: 834153.
16. Santilli F, Vazzana N, Liani R, Guagnano M, Davi G (2012) Platelet activation in obesity and metabolic syndrome. Obes Rev 13: 27-42.
17. Jeong HR, Lee HS, Shim YS, Hwang JS (2022) Positive Associations between body mass index and hematological parameters, including RBCs, WBCs, and platelet counts, in korean children and adolescents. Children 9: 109.
18. Suominen P, Punnonen K, Rajamaaki A, Irjala K (1998) Serum transferrin receptor and transferrin receptor-ferritin index identify healthy subjects with subclinical iron deficits. Blood 92: 2934-2939.
19. Hallberg L, Bengtsson C, Lapidus L, Lindstedt G, Lundberg PA, et al. (1993) Screening for iron deficiency: An analysis based on bone-marrow examinations and serum ferritin determinations in a population sample of women. Br J Haematol 85: 787-798.

20. Prinsze FJ, de Groot R, Timmer TC, Zalpuri S, van den Hurk KJT (2021) Donation-induced iron depletion is significantly associated with low hemoglobin at subsequent donations. Transfusion 61: 3344-3352.

21. Killip S, Bennett JM, Chambers MD (2007) Iron deficiency anemia. American Family Physician 75: 671-678.

22. Kiss JE (2015) Laboratory and genetic assessment of iron deficiency in blood donors. Clin Lab Med 35: 73-91.

23. Holbro A, Volken T, Buser A, Sigle J, Halter J, et al. (2017) Iron deficiency and thrombocytosis. Vox Sanguinis 112: 87-92.

24. Fernandez-Real J-M, Ricart-Engel W, Arroyo E, Balanca R, Casamitjana-Abella R, et al. (1998) Serum ferritin as a component of the insulin resistance syndrome. Diabetes Care 21: 62-68.

25. Piperno A, Trombini P, Gelosa M, Mauri V, Pecci V, et al. (2002) Increased serum ferritin is common in men with essential hypertension. Journal of Hypertension 20: 1513-1518.

26. He A, Yang X, Ding Y, Sun L, Shi M, et al. (2022) The association between serum ferritin and blood pressure in adult women: A large cross-sectional study. Clinical Experimental Hypertension 1-7.

27. Oshaug A, Bugge K, Bjonnes C, Borch-Iohnsen B, Neslein I (1995) Associations between serum ferritin and cardiovascular risk factors in healthy young men. A cross sectional study. Eur J Clin Nutr 49: 430-438.