

Medical and laboratory assessment for regular blood donors in Sulaimani Blood Bank, Iraq

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Introduction: It has been suggested that blood donation reduces risks of developing cardiovascular diseases such as heart failure, atherosclerosis, and stroke. Although there are known benefits of blood donation, the inclination of people of the Kurdistan Region of Iraq to donate blood is not known. Therefore, the aim of this study was to determine demographic and blood biochemical profiles of regular and first-time blood donors in the Sulaimani province of North Iraq.

Methods: A cross-sectional study was conducted at the Sulaimani Blood Bank, during the period of April 1, 2016 to March 28, 2017, on convenient samples of 100 regular and 100 first-time blood donors. Donor particulars were obtained from blood bank records. The cholesterol, triglyceride, low-density lipoprotein, ferritin, vitamin D3, and uric acid concentrations of blood samples were determined.

Results: The main reason for blood donation by regular blood donors was headache (45%), while for the first-timers it was to help relatives (31%). The low-density lipoprotein and ferritin concentrations were significantly ($p=0.001$) lower in the blood of regular donors than first-timers.

Conclusion: The study shows that regular blood donation is beneficial for the maintenance of health of donors.

Keywords: regular blood donor, first-time blood donor, lipid profile, vitamin D3, ferritin

Introduction

Around the world, donors contribute more than a million blood units each year. Even at this rate, the global demand for blood is far from being met. To ensure adequate supply, there is need to develop better organized systems to encourage blood donation and to overcome the fragile balance between supply and demand for blood. Although one of the ways to encourage blood donation is by offering remunerations, the European Union prohibits this practice.¹

Blood donation has not been common practice in Iraq until recently. In fact, as late as 2010, Abdulsalam,² during his tenure as head of the blood transfusion center of the Iraq Al-Yarmouk Teaching Hospital in Baghdad, reported that the blood transfusion services were poorly developed in Iraq. Only after recent establishment of well-designed and high-quality services and facilities could the Iraqi Ministry of Foreign Affairs, with the cooperation of the National Blood Bank, organize a blood donation drive to support the police and army in the fight against terrorism.³

HIV, hepatitis B and C, and syphilis are known to be transmitted through blood. Thus, the World Health Organization has recommended that all donated blood be screened for these diseases. Currently, at least 13 countries worldwide do not screen for one or more of these infections.⁴ These countries are primarily underdeveloped

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or developing, and so blood supply is neither sufficient nor safe. In certain societies, donated blood may also need to be screened for drugs, toxic chemicals, and pesticides to ensure safety.⁵

Despite the availability of plasma expanders and synthetic and semi-synthetic blood products, whole blood from donors is still highly essential for the management of most health care emergencies. Although blood donation is relatively safe with hardly any harmful side effects, except for mild and temporary symptoms like weakness, nausea, and sweating, the number of donors remains low. Rarely, except in the most susceptible people will severe symptoms such as total loss of consciousness and seizures manifest.⁶

Blood transfusion is used to alleviate anemias. In the treatment of refractory chronic anemia, including thalassemia, sickle cell anemia, myelodysplastic syndrome, and aplastic anemia, blood transfusion is a fast, direct, and effective therapy.⁷ However, repeated transfusion may result in iron overload.⁸ Thus, in these cases, if iron-chelating therapy is not employed, the increase in iron load from hemolysis or breakdown of senescent erythrocytes would result in accumulation of iron in the liver and reticuloendothelial cells that could result in progressive and fatal cell, tissue, and organ destruction. Iron-chelating therapy would reduce the tendency for iron overload and consequential deleterious effects in long-term blood transfusion.⁹

There is a direct relationship between reduced frequency of cardiovascular diseases and blood donation.¹⁰ It seems that regular blood donors have lower risks for the development of myocardial infarction than nonblood donors.¹¹ However, it is still unclear as to how blood donations would lower tendency for development of cardiovascular diseases. It is hypothesized that with blood donation, there is inhibition of lipid oxidation from the systemic reduction of iron and/or ferritin that will cause decrease in low-density lipoprotein (LDL) blood level and reducing incidence of cardiovascular diseases.¹²

In this study, the objective was to determine the effect of regular blood donation on the quality of life, well-being, and selected pathophysiological parameters of donors.

Materials and methods

Study design

A cross-sectional study was carried out on adult males, aged 18–60 years, at the Sulaimani Blood Bank from April 1, 2016 to March 28, 2017. Convenient samples used in this study were of 2 groups: Group 1 comprised of 100 regular blood donors with 4 donations over the last 2 years or 6 donations in last 3 years and Group 2 comprised of 100 first-time donors. The participants were examined for symptoms of diseases.

The data were collected through interview of participants and with the use of a questionnaire. Participant particulars were obtained from records kept at the Blood Bank.

Exclusion criteria

Individuals with systemic diseases including hypertension, diabetes, and/or cardiovascular diseases, and those aged below 18 or above 60 years, or with hemoglobin concentration <125 g/L were excluded from the study.

Questionnaire

The questionnaire covers the sociodemography of donors that included age and residence, reason for and frequency of donation, body mass index (BMI), whether participants had history of chronic diseases and/or hyperlipidemia, were smokers, and/or consumed alcohol.

Examination and blood collection

Approximately 5 mL blood was collected from each participant for complete blood count before centrifuging at 300× *g* to obtain plasma. Diagnosis of polycythemia was determined from the hemogram and dyslipidemia from blood biochemical analysis. The patients were also examined for hypertension using a sphygmomanometer. The plasma ferritin and vitamin D3 concentrations were determined by radioimmunoassay using the Cobas e411 (Roche, Basel, Switzerland) immunoanalyzer. The lipid profile of 12-hour fasted donors, comprising of cholesterol, triglyceride, and LDL concentrations, and uric acid concentrations were determined by spectrophotometry using the Cobas c111 (Roche) chemistry analyzer and standard test kits (Roche).

Ethical considerations

The Ethics Committee of Sulaimani Blood Bank approved the study following the receipt of informed written consent from all of the participants. The confidentiality of participants was wholly preserved.

Statistical analysis

Statistical Package for Social Sciences version 22.0 (IBM Corporation, Armonk, NY, USA) was used. Descriptive statistics presented as mean ± standard deviation and frequencies as percentages. Kolmogorov–Smirnov analysis verified the normality of the data set. χ^2 test was used for comparison between categorical data, while Fishers exact test was used when expected variable were <2% of total number of variables. Additionally, independent sample *t*-test was used to compare between means. In all statistical analysis, level of significance (*p*-value) was set at $\alpha=0.05$.

Results

Demography

The regular donors were significantly ($p=0.03$) older than the first-timers. Most regular donors were 30 years or older, while 49% of first-time donors were <30 years old. Among the regular donors, the highest numbers were seen in those aged 30–39 years (Table 1). Most blood donors, both regulars and first-timers, were urban residents (Table 2).

Lifestyle

There is a significant ($p=0.02$) association between blood donors and obesity. Most of the blood donors were at least overweight if not obese (Table 3). There is almost equal distribution of smokers and nonsmokers among blood donors, although there were slightly more smokers among the first-timers. Most blood donors did not consume alcohol. The BMI of regular donors at 27.8 ± 4.7 was slightly ($p<0.006$) higher than that of first-timers at 26.1 ± 3.6 .

Lipid profile

The total plasma cholesterol level of first-time blood donors was slightly higher than regular donors, whereas the triglyceride level slightly lower (Table 4). Most blood donors showed normal plasma LDL level. However, between donor groups, the regulars had lower plasma LDL than the first-timers (Table 5).

Blood biochemistry

Most blood donors had low serum vitamin D3 and normal ferritin and uric acid levels (Table 6). However, the plasma ferritin concentration of first-time donors was significantly ($p<0.001$) higher than regular donors (Table 4).

Reason for donating blood

Among the reasons for blood donation by regulars were to relieve headaches, polycythemia, insomnia, sleepiness, neck and shoulder pains, and dizziness. The reasons for donation by the first-timers were to help relatives, because of polycythemia, headaches, sleepiness, and neck and shoulder pains. There were more first-timers without health

Table 1 Age distribution of male blood donors

Age (years)	Regular donors		1st-time donors		χ^2	p-values
	Number	%	Number	%		
<30	29	29.0	49	49.0	8.9	0.03
30–39	42	42.0	27	27.0		
40–49	21	21.0	18	18.0		
≥ 50	8	8.0	6	6.0		
Mean \pm SD	35.2 \pm 8.5		32.5 \pm 9.5			

Abbreviation: SD, standard deviation.

Table 2 Distribution of residence male blood donors

Residence	Regular donors		1st-time donors		χ^2	p-values
	Number	%	Number	%		
Urban	82	82.0	87	87.0	0.9	0.3
Rural	18	18.0	13	13.0		

Table 3 Distribution of BMI and lifestyle of male blood donors

Variable	Regular donors		1st-time donors		χ^2	p-values
	Number	%	Number	%		
BMI					7.7	0.02
Normal	22	22.0	35	35.0		
Overweight	54	54.0	54	54.0		
Obese	24	24.0	11	11.0		
Smoking					0.5	0.4
Yes	57	57.0	52	52.0		
No	43	43.0	48	48.0		
Alcohol consumption					0.09	0.7
Yes	29	29.0	27	27.0		
No	71	71.0	73	73.0		

Abbreviation: BMI, body mass index.

Table 4 Physical and plasma biochemical parameters of male blood donors

Variable	Regular donors	1st-time donors	t-test*	p-values
	Mean \pm SD	Mean \pm SD		
Age (years)	35.2 \pm 8.5	32.5 \pm 9.5 ^a	2.1	0.04
BMI	27.8 \pm 4.7	26.1 \pm 3.6 ^a	2.7	0.006
Cholesterol (mmol/L)	197.6 \pm 43.8	209.5 \pm 45.6	1.8	0.06
Triglycerides (mmol/L)	250 \pm 134	216 \pm 114	1.9	0.06
LDL (mmol/L)	93.3 \pm 32.8	105.7 \pm 34.7 ^a	2.5	0.01
Ferritin (ng/L)	78.6 \pm 75.3	158.8 \pm 99.1 ^a	6.4	<0.001
Vitamin D3 (U/L)	19.6 \pm 5.9	18.5 \pm 6.6	0.8	0.4
Uric acid (μ m/L)	6.3 \pm 1.8	6.1 \pm 1.5	0.7	0.4

Notes: *Student's t-test was used for measuring the significance between regular blood donors and 1st-time blood donors for the listed variables. ^aSignificant difference between 1st-time donors compared to regular donors.

Abbreviations: BMI, body mass index; LDL, low-density lipoprotein; SD, standard deviation.

Table 5 Distribution of lipid profile in regular male blood donors and 1st-time male donors

Variable	Regular donors		1st-time donors		χ^2	p-values
	Number	%	Number	%		
Cholesterol					2.0	0.1
Normal	54	54.0	44	44.0		
High	46	46.0	56	56.0		
Triglycerides					2.8	0.09
Normal	43	43.0	55	55.0		
High	57	57.0	45	45.0		
LDL					3.7 ^a	0.05
Normal	99	99.0	94	94.0		OR =6.3
High	1	1.0	6	6.0		CI ={0.7–53.4}

Note: ^aFisher's exact test.

Abbreviations: CI, confidence interval; LDL, low-density lipoprotein; OR, odds ratio.

Table 6 Distribution of male blood donors with normal and abnormal plasma vitamin D3, ferritin, and uric acid concentrations

Variable	Regular donors		1st-time donors		χ^2	p-values
	Number	%	Number	%		
Vitamin D3					0.1 ^a	0.7
Low (>30 ng/mL)	95	95.1	96	96.0		
Normal	5	5.0	4	4.0		
Serum ferritin					21.2 ^a	<0.001
Low (30–400 ng/L)	25	25.0	3	3.0		
Normal	74	74.0	93	93.0		
High	1	1.0	4	4.0		
Serum uric acid					1.8	0.1
Normal (3.3–7 mg/dL)	73	73.0	81	81.0		
High	27	27.0	19	19.0		

Note: ^aFishers exact test.

reasons than regular donors that volunteered to donate blood (Table 7).

Discussion

There is a serious blood shortage of blood donors, even in some of large cities, despite the desperate need for blood in medical practice.¹³ A high proportion of blood donation comes from donors with health issues or those that have relatives that require blood to compensate for loss during surgery or to treat anemias.

We determined the demography and physical and health of characteristics of regular and first-time blood donors. The study showed that there were more regular blood donors among people aged at least 30 years. Similar in the USA, older people aged from 40 to 49 years tended to donate more units of blood than the young.¹⁴ From 1996 to 2005,

Table 7 Reasons for donation by the male blood donors

Causes of donation	Regular donors		1st-time donors		χ^2	p-values
	Number	%	Number	%		
Headache	45	45.0	18	18.0	65.5 ^a	<0.001
Polycythemia	15	15.0	20	20.0		
Volunteer	10	10.0	23	23.0		
Insomnia	9	9.0	0	–		
Sleepiness	7	7.0	2	2.0		
Neck and shoulder pain	5	5.0	2	2.0		
Dizziness	4	4.0	0	–		
Blood donation for relatives	0	–	31	31.0		
Others	5	5.0	4	4.0		

Note: ^aFishers exact test.

however, after adjusting to population trend, the number of donors decreased by approximately 10%.¹⁵

Repeat blood donors also showed reduction in BMI, blood lipid, and cholesterol levels. Thus, regular blood donation is beneficial to health because the lowering of plasma total cholesterol and LDL levels reduce risk of developing cardiovascular diseases.¹⁶

Obesity-related hypertension is on the increase worldwide, and the number of adults with hypertension is predicted to increase by 60% by year 2025.¹⁷ Hypertension often causes migraine headaches. Our study showed that headache was the main reason for blood donation among regulars, while for first-time donors it was to help relatives. This finding is in agreement with that of another study conducted in Iran¹⁸ which concluded that headache was the main reason of regular blood donation. Although it was not determined in our study, it is possible that most donors with headaches may have had hypertension. It seems, according to a recent study, that blood donation is beneficial because it decreases the blood pressure of hypertensive regular donors.¹⁹

Our study showed that obesity was significantly associated with regular blood donations. Obesity is also generally associated with middle age, and this is also true for blood donors.²⁰ It was shown that phlebotomy will reduce body iron stores, lower blood pressure, and reduce the risk of developing hyperglycemia and cardiovascular diseases, characteristics most often associated with obesity.²¹ People with higher BMI, advanced age, and low physical activity tend to show unfavorable plasma lipid profile that may predispose them to cardiovascular diseases. Thus, obese people may have greater inclination to donate blood because of these benefits.¹⁹

Plasma LDL is one of the biomarkers of cardiovascular events, especially coronary heart disease.¹⁸ However, among the parameters, plasma LDL/high-density lipoprotein (HDL) ratio is a better indicator of risk for coronary heart disease than either plasma LDL or HDL alone.²² Our study showed that regular blood donors had lower plasma LDL level than the first-timers. This finding is consistent with that shown by earlier studies in Nigeria,²³ Indonesia,²⁴ and India.²⁵ The effect on lowering plasma LDL with blood donation was also shown in a study in Ethiopia.²⁶ That study showed blood donors had significantly lower LDL than the reference values. However, not all studies showed that blood donation is associated with lower risk of cardiovascular diseases. For example, in the USA, it was shown that there is no significant association between blood donation or risk of myocardial infarction.²⁷ However, in our study, the low plasma LDL

among regular blood donors is presumed to help reduce incidence of cardiovascular diseases.

The mean blood ferritin level seems to decrease with increase in number donations,²⁸ which is suggested to be associated with reduced iron stores and risk of myocardial infarction.²⁹ In fact, high serum ferritin is strongly associated with cardiac disease or fatal coronary heart disease.³⁰ In our study, the plasma ferritin was lower in regular than first-time donors. Similar studies conducted in Malaysia²⁸ and India³¹ showed regular blood donors to have low serum iron concentrations, which also suggest that frequent blood donations reduce iron storage.

Similar to other cross-sectional studies related to blood donation, the limitation points to this research that might strongly affecting the results of this study include not assessing the temporal relationship, the availability of only a single blood bank in the city, and the selection bias.

Conclusion

In conclusion, the study shows that regular blood donation is beneficial for the improvement of lipid profile and cardiovascular diseases. There were fewer regular blood donors with high LDL concentrations than first-timers. The study also shows that headache was the predominant reason for donating blood among regulars, while blood donation for relatives was the main reason for donation among first-time donors. The serum ferritin levels, which are a reflection of storage iron, were lower among regular than first-time blood donors. The elderly and obese were the more frequent blood donors.

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Disclosure

The authors report no conflicts of interest in this work.

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