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A descriptive study of effect of blood donation on lipid profile in healthy volunteers

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Abstract

Introduction: Blood donation is a process by which a blood donor voluntarily has drawn the blood for the shortage in the blood bank or for subsequent use in blood transfusion. There is considerable shortage of blood even in large metropolitan cities with supply being less than 50% than the requirement. **Materials and methods:** This is descriptive study. Blood donation camp was organized in RIMS, Ranchi. 60 healthy males who were willing to participate were selected for the study. The Inclusion criteria being age between 18 years and 25 years, weight between 50 kg and 60 kg and haemoglobin levels should be > 10 mg %. Exclusion criteria are volunteers having history suggestive of chronic illnesses like Hypertension, Diabetes Mellitus, Hepatitis B, Haemoglobinopathies, Bleeding disorders, Alcoholics, Chronic smokers, Drug abuser, H/O blood donation within last one month. The samples of 60 healthy volunteers were collected in fasting condition. With all aseptic condition, 5 ml venous blood was withdrawn and centrifuged. Separated serum was used for further analysis. **Results:** All the parameters of lipid profile, e.g. TC, LDL, VLDL except HDL was highly significantly decreased (p<0.001) after 7th and the effects continued till 30th day after blood donation, which was highly significantly decreased (p<0.05, HDL). It was significantly increased (p <0.05) after 7th and 30th day of blood donation. At 90th day, all values were normalised. **Conclusion:** Blood donation has lipid lowering effects as early as 7 days after blood donation and effects were maintained till 30th day after blood donation. During this period, i.e. on day 7 and 30, there was significant decrease in TC, LDL, TG and VLDL levels with significant elevation of HDL concentration. The lipid profile returns to normal after 90 days of blood donation in healthy volunteers.
Keywords: Blood donation, TC, LDL, VLDL, HDL, Hypertension, Diabetes Mellitus.

Introduction

Blood donation is a process by which a blood donor voluntarily has drawn the blood for the shortage in the blood bank or for subsequent use in blood transfusion. There is considerable shortage of blood even in large metropolitan cities with supply being less than 50% than the requirement[1].The donated blood is used for various patients, of the total blood available in blood banks. Following are the indications to patients of acute anaemia caused by surgical haemorrhage, traumatic haemorrhage, non-surgical critical illness, early sepsis with inadequate oxygen delivery, septic shock and acute coronary syndrome with ischaemia[2]. The donated blood is also used for various patients. Chronic anaemia caused by chronic blood loss (Hepatic disorders, Bleeding disorders), decreased erythropoiesis (Malignancies, Chemotherapy, Bone marrow, disorders, renal disorders, Nutritional insufficiencies)[3].Study done by Meyers et al and Ascherio et al, it was found that there is a reduction in the cardiovascular events with repeated blood donation and the mechanism proposed by these workers was "Iron Hypothesis." Few studies also claimed the benefit due to blood donation is because of effect on "Lipid Profile" (Hypolipidaemic effect) [4,5].

The present study was an effort to find out the strength of the claim in the hypothesis that Blood donation has lipid lowering effect. Also, others have reported the benefit on lipid profile after 3 months and more. We tried to investigate whether this effect is still earlier, i.e. after 7 days or 1 month of donation.

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Materials and methods

Study design
A descriptive study
Study location
Department of Biochemistry, RIMS, Ranchi.
This is descriptive study. Blood donation camp was organized in RIMS, Ranchi. 60 healthy males who were willing to participate were selected for the study.
Inclusion criteria
The Inclusion criteria being age between 18 years and 25 years, weight between 50 kg and 60 kg and haemoglobin levels should be > 10 mg %.
Exclusion criteria
Volunteers having history suggestive of chronic illnesses like Hypertension, Diabetes Mellitus, Hepatitis B, Haemoglobinopathies, Bleeding disorders, Alcoholics, Chronic smokers, Drug abuser, H/O blood donation within last one month.
The samples of 60 healthy volunteers were collected in fasting condition. With all aseptic condition, 5 ml venous blood was withdrawn and centrifuged. Separated serum was used for further analysis.
Total cholesterol was estimated by CHOD-POD method by using Accurex kit. HDLc was estimated by Phosphotungstic acid method by using Accurex kit. TG was estimated by GPO-POD method by using Accurex kit. LDLc was estimated by using formula of Friedewald et al.

$LDLc = TC - HDLc - VLDL$ and $VLDL = TG/5$

The critical level of significance was set at $p < 0.05$. The results were analysed by One-Way repeated measures.
Results
Effect of blood donation on lipid profile.
On Day '7'
There was statistically significant drop in Total Cholesterol from $(172.4 + 6.68)$ to $(136.0 + 4.9)[-21.1\%]$; $p < 0.001$, LDL from (90.59

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+ 6.12) to (53.61 + 5.191)[-40.82%]; p < 0.001 and TG from (118.2 + 6.87)to (87.07 + 6.431)[-26.33%]; p<0.01 and a fall in VLDL from (23.64 + 1.37) to (17.66 + 1.26)[25.3%]; p < 0.01. Whereas, the HDL

readings showed a significant rise from (58.13 + 2.02) to (64.74 + 1.57)[11.37%] p < 0.05.

Table 1: Effect of Blood Donation on Lipid Profile on Day 7

Lipid Profile Parameters	Baseline (0 Days)	Values (mg%) (Day 7)	Actual Difference	Percent
Total Cholesterol	172.4 + 6.68	136.00 + 4.97	-36.40	- 21.11
HDL	58.13 +2.02	64.74 +1.57	6.61	11.37
LDL	90.59 + 6.12	53.61 + 5.19	-36.98	-40.82
TG	118.2 + 6.87	87.07 + 6.43	-31.13	-26.34
VLDL	23.64 + 1.37	17.66 + 1.26	-5.98	-25.30

Values shown are Mean + SEM. SEM= Standard Error of mean. P value is in comparison with the Baseline, i.e. Day 0 NS= Not Significant = p < 0.05= p < 0.01= p < 0.001.

On Day '30'
Effect on Lipid Profile.
There was a continued significant fall as compared with baseline in the levels of Total cholesterol to (152.30 + 2.08)[-11.66%];p < 0.05; LDL to (67.79 + 2.780[-25.17%]; p < 0.01, TG to (96.58 + 4.49) [-18.29%]; p < 0.05, VLDL to (19.32 + 0.90)[-18.27%];p<0.05 and significant rise in HDL levels as compared with baseline to (65.16 + 1.33)[12.09%]; p < 0.05.

Table 2: Effect of Blood Donation on Lipid Profile on Day 30

Lipid Profile Parameters	Baseline (0 Days)	Values (mg %) (Day 7)	Actual Difference	Percent
Total Cholesterol	172.4 + 6.68	152.3 + 2.081	-20.1	-11.6589
HDL	58.13 + 2.02	65.16 + 1.33	7.03	12.09358
LDL	90.59 + 6.12	67.79 + 2.78	-22.8	-25.1683
TG	118.2 + 6.87	96.58 + 4.487	-21.62	-18.291
VLDL	23.64 + 1.37	19.32 + 0.8974	-4.32	-18.2741

Values shown are Mean + SEM. SEM= Standard Error of mean. P value is in comparison with the Baseline i.e. Day 0 NS = Not Significant = p < 0.05 = p < 0.01= p < 0.001.

On Day '90'
On lipid profile, the values were Total Cholesterol (165.20 + 4.02) [-4.18%], HDL (63.80 + 3.93) [9.75%], LDL (78.08 + 5.42)[-13.81%], TG (116.60 + 3.07)[-1.35%] and VLDL (23.32 + 3.02) [-1.35%]

Table 3: Effect of Blood Donation on Lipid Profile on Day 90

Lipid Profile Parameters	Baseline (0 Days)	Values (mg %) (Day 7)	Actual Difference	Percent
Total Cholesterol	172.4 + 6.68	165.2 + 4.016	-7.2	-4.17633
HDL	58.13 + 2.02	63.8 + 3.932	5.67	9.754
LDL	90.59 + 6.12	78.08 + 5.42	-12.51	-13.8095
TG	118.2 + 6.87	116.6 + 3.074	-1.6	-1.35364
VLDL	23.64 + 1.37	23.32 + 0.6148	-0.32	-1.35364

Values shown are Mean + SEM.
SEM= Standard Error of mean. P value is in comparison with the Baseline, i.e. Day 0 NS= Not Significant = p < 0.05 = p < 0.01= p < 0.001

Discussion
At the end of 7 days
There was a significant drop in Total cholesterol, TG, LDL and in VLDL levels. This drop may be because of utilisation of cholesterol and TG for the synthesis of new cells in the process of erythropoiesis. Blood has cellular components like RBC, WBC, platelets and it is a well-established fact that TG and Cholesterol forms the main structural component of cell membranes. Our study was in agreement with Kaliuzhnyĭ IT study[6].This whole impact on the lipid profile appears to be because of increased demand and less supply of cholesterol by body cholesterol pool.

At the end of 30 days
We found significant decrease in lipid profile, except HDL getting normalized at this point of time. Total cholesterol, LDL, VLDL and TG levels were significantly low than baseline and HDL significantly higher than baseline indicating that still the cholesterol is being utilised for erythropoiesis and the rate of regeneration of cholesterol may not be enough to make lipid profile levels to be normal[7].
There was 10% significant rise in the levels of HDL cholesterol compared with baseline, which may suggest that the peripheral transport of cholesterol back to liver and then to blood, which is termed as reverse cholesterol transport might still be going on[8].

At the end of study period, i.e. 90 days
The levels of TC, LDL, VLDL and TG were more or less restored to normal. The only changes worth noting were of HDL showing 9.8% rise in levels from baseline values. Our study was in agreement with

Kumar H, Mayer DG and Bhardwaj[9].Rise in HDL probably may suggest an additional beneficial effect due to increased peripheral transport of HDL-cholesterol to meet the increased requirement of erythropoiesis. This process is also known as reverse cholesterol transport. According to Gutteridge JM and Halliwell B in"Iron hypothesis," iron is a potent catalyst for radical production in vitro. The erythropoiesis after blood donation consumes iron and leads to reduction in serum ferritin. The iron-catalysed Fenton reaction generates a range of potent oxidants that can cause oxidation of lipids. Similar hypothesis given by [Gebre-Yohannes A, Tommi Pekka and Van Hoydonck PG, Gutteridge JM, Meyers DG Van Jaarsveld H and Pool GF et al, Salonen JT and Tuomainen TP. This causing more generation of oxidative lipid products subsequently leading to more carriage to liver in the form of HDL, hence the raised levels of HDL[10].

Conclusion
Blood donation has lipid lowering effects as early as 7 days after blood donation and effects were maintained till 30th day after blood donation. During this period, i.e. on day 7 and 30, there was significant decrease in TC, LDL, TG and VLDL levels with significant elevation of HDL concentration. The lipid profile returns to normal after 90 days of blood donation in healthy volunteers.

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