

EFFECT OF BLOOD DONATION ON LIPID PROFILE IN HEALTHY VOLUNTEERS- A SHORT-TERM PILOT STUDY

Sunita Avinash Turankar¹, Avinash Vikram Turankar², Seema Vaidya³, Saurabh Balpande⁴

¹Ex-Assistant Professor, Department of Biochemistry, Grant Medical College, Mumbai, Maharashtra, India.

²Associate Professor, Department of Pharmacology, Government Medical College, Nagpur, Maharashtra, India.

³Ex-Professor, Department of Biochemistry, Government Medical College, Nagpur, Maharashtra, India.

⁴Assistant Professor, Department of Pharmacology, Government Medical College, Nagpur, Maharashtra, India.

ABSTRACT

BACKGROUND

It is a known fact that giving the blood helps the other in more than one way. One pint of blood given by the donor can save the lives of as many as three individuals.

The aim of the study was to estimate the effect of lipid profile after 7th, 30th and 90th days of blood donation.

MATERIALS AND METHODS

This is a descriptive study. 30 healthy volunteers were included in the study without any major illness. Total cholesterol was estimated by CHOD-POD method. HDLc was estimated by phosphotungstic acid method. TG was estimated by GPO-POD method. LDLc was estimated by using formula of Friedewald et al.

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

The act of blood donation has favourable hypolipidaemic effect even in normal healthy volunteers, which starts as early as 7 days and gets normalised by 90 days with continued raised levels of HDL.

KEY WORDS

Blood Donation, Lipid Profile.

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BACKGROUND

“Safe Blood starts with me, Blood saves lives” was the WHO theme for 2000 AD.⁽¹⁾ 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.⁽²⁾ There is considerable shortage of blood even in large metropolitan cities with supply being less than 50% than the requirement.⁽³⁾

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/ non-trauma haemorrhage, critical illness, early sepsis with inadequate oxygen delivery, septic shock and acute coronary syndrome with ischaemia. 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).⁽⁴⁾

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Corresponding Author:

Dr. Avinash Vikram Turankar,
Plot No. 55, Cosmos House,
Trimukta Nagar, Nagpur-440022,
Maharashtra, India.

E-mail: aturankar@hotmail.com
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There is a definite benefit to the recipient after the blood donation. But there is also a positive health related impact of blood donation on the donor himself or herself. Some studies have shown that blood donation has potential benefit in coronary artery disease. The study done by Salonen et al. It was found that donation of blood is associated with reduced risk of myocardial infarction.⁽⁵⁾

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.”^{(6),(7)}

Few studies also claimed the benefit due to blood donation is because of effect on “Lipid Profile” (Hypolipidaemic effect).^{(8),(9),(10)}

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.

MATERIALS AND METHODS

This is descriptive study. Blood donation camp was organised in Industrial Training Institute (ITI) in Nagpur. 30 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 being 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 30 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.⁽¹¹⁾ HDLc was estimated by phosphotungstic acid method by using Accurex kit.^{(12),(13)}

TG was estimated by GPO-POD method by using Accurex kit.^{(14),(15)} LDLc was estimated by using formula of Friedewald et al.⁽¹⁶⁾

$$\text{LDLc} = \text{TC} - \text{HDLc} - \text{VLDL} \text{ and } \text{VLDL} = \text{TG}/5$$

The critical level of significance was set at $p < 0.05$. The results were analysed by One-Way repeated measures.

ANOVA with Tukey's post test by using trial version GraphPad Prism ver. No. 4 (Trial Version).

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 ± 6.12) to (53.61 ± 5.19) [-40.82%]; $p < 0.001$ and TG from (118.2 ± 6.87) to (87.07 ± 6.43) [-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%] $p < 0.05$.

Lipid Profile Parameters	Baseline (0 Days)	Values (mg%) (Day 7)	Actual Difference	Percent	P Value
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	**

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

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 ± 2.78) [-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%]; $p < 0.05$.

Lipid Profile Parameters	Baseline (0 Days)	Values (mg%) (Day 30)	Actual Difference	Percent	P value
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	*

Table 2. Effect of Blood Donation on Lipid Profile on Day 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 '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%]

Lipid Profile Parameters	Baseline (0 Days)	Values (mg %) (Day 90)	Actual Difference	Percent	P value
Total Cholesterol	172.4 ± 6.68	165.2 ± 4.016	-7.2	-4.17633	NS
HDL	58.13 ± 2.02	63.8 ± 3.932	5.67	9.754	NS
LDL	90.59 ± 6.12	78.08 ± 5.42	-12.51	-13.8095	NS
TG	118.2 ± 6.87	116.6 ± 3.074	-1.6	-1.35364	NS
VLDL	23.64 ± 1.37	23.32 ± 0.6148	-0.32	-1.35364	NS

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

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* = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$

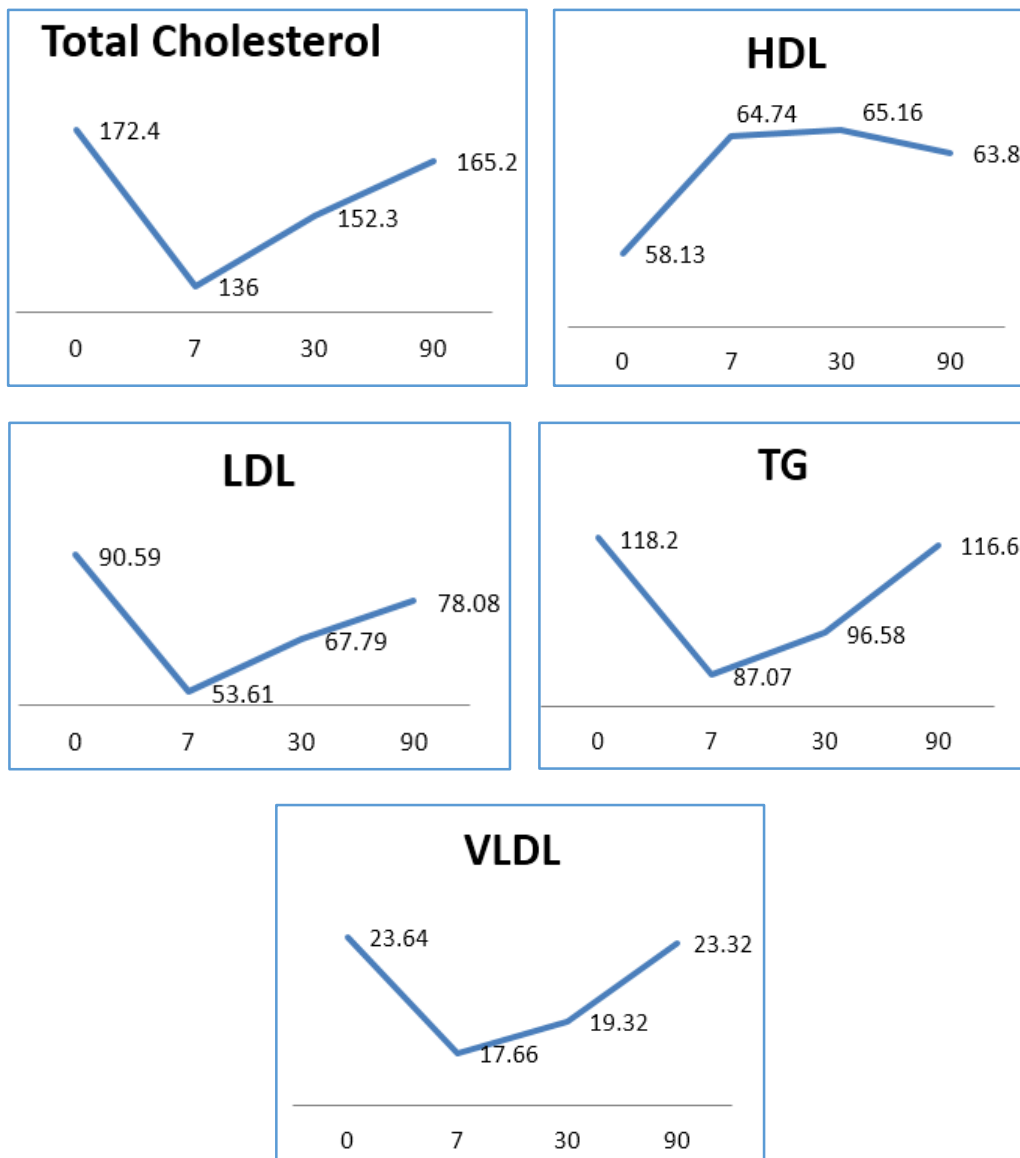


Figure 1. Graph showing Effect of Blood Donation on Lipid Profile in Healthy Volunteers at 7, 30 and 90 days after Blood Donation

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.⁽¹⁷⁾ Our study was in agreement with Kaliuzhnyi IT study.⁽¹⁸⁾

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 normalised 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.

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.

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,⁽¹⁹⁾ Mayer DG⁽²⁰⁾⁽⁶⁾ and Bhardwaj.⁽¹⁾

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.⁽²¹⁾ The erythropoiesis after blood donation consumes iron and leads to reduction in serum ferritin.⁽²²⁾ The iron-catalysed Fenton reaction generates a range of potent oxidants that can cause oxidation of

lipids.⁽²³⁾⁽²⁴⁾ Similar hypothesis given by [Gebre-Yohannes A,⁽²⁵⁾ Tommi Pekka⁽²⁶⁾ and Van Hoydonck PG,⁽²⁷⁾ Gutteridge JM,⁽²⁸⁾ Meyers DG⁽²⁰⁾ Van Jaarsveld H and Pool GF et al,⁽²⁹⁾ Salonen JT and Tuomainen TP.⁽⁵⁾ 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.

It was short-term study done on normal healthy volunteers with small sample size.

Further studies in repeated blood donors may add newer insights. This may be tested in eligible blood donors with hyperlipidaemia. Role of blood donation can also be explored to find out the preventive role in atherosclerosis in well-designed studies.

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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