

# EFFECT OF DONOR VARIABLES ON PLATELET YIELD AMONG DONOR UNDERGOING PLATELETPHERESIS AT TRANSFUSION MEDICINE DEPARTMENT, DHAKA MEDICAL COLLEGE HOSPITAL (EXPERIENCE OF 350 PROCEDURES)

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## Abstract

**Background:** The platelet transfusions help in prevention of bleeding related complications and thus prevents morbidity and mortality in thrombocytopenic patients.

Platelet transfusion plays an important role in the treatment of haematological, oncological, surgical, and transplant patients. Platelets are transfused by two methods i) by fractionation of whole blood and ii) by platelet apheresis.

Over the last decade there has been a trend towards the use of SDPs rather than pooled random donor platelets in thrombocytopenic patients. Optimization of platelet yield is an emerging issue to identify factors which may help in selecting donors to obtain higher platelet yields in shorter time and consequently better clinical outcome.

**Objective:** The quality of single donor platelets (SDP) in terms of yield influences the platelet recovery in the recipient. The aim was to identify the SDP donor factors that influence platelet yield.

**Methods:** The study was undertaken at transfusion medicine department, DMCH from 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2017.

The study included 350 plateletpheresis procedures. All procedures were performed according to manufacturer's manual and standard operating procedure.

**Results:** During the period of study, 350 platelet pheresis donors were studied. All of the donors were male. Platelet yield showed high statistical significance with pre donation platelet count and its indices. ( $p=0.000$ ). Statistical significant negative correlation was seen between pre donation Hb concentration and the platelet yield. ( $p=0.005$ ). No statistical significance was seen height ( $p=0.933$ ), weight ( $p=0.760$ ) of donor on platelet yield.

**Conclusion:** Platelet recovery in the patient is influenced by the transfused dose of platelets, which in turn is dependent on the quality of the platelet product in terms of yield. Various donor factors such as pre donation platelet count and haemoglobin concentration may affect platelet yield.

**Keywords:** Single donor plateletpheresis; Cell separator, Platelet yield.

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## Introduction:

Platelet transfusion success depends on rational use of platelet components and on the quality of the component. Platelet recovery in a patient is influenced by the transfused dose of platelets which in turn is dependent on the platelet yield.<sup>1</sup>

Platelet transfusions can be done either as i) a pool of 4 to 6 units of random donor platelet, or ii) 1 unit of single donor platelet(SDP) is transfused.<sup>2</sup>

Plateletpheresis (apheresis means to remove) is a procedure designed to collect large number of platelets from single donor thereby giving more consistent product<sup>3</sup>

As per guidelines of American association of blood banks plateletpheresis (Single Donor Platelets) unit must have platelet count of  $3 \times 10^{11}$  which in turn raises platelet count by 30,000-60,000 per micro litre and is equivalent to 4-6 units of random platelet concentrates<sup>4</sup>

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The quality of the product is most important factor which will decide therapeutic benefit to patients. The American Association of Blood Bank (AABB) standards requires that an apheresis platelet component contain at least  $3 \times 10^{11}$  platelets in 90% of sampled units<sup>5</sup> Leukocyte count of the apheresis platelet must be  $<5 \times 10^6$  as per AABB Standards and  $<1 \times 10^6$  as per European guidelines. The red cell contamination should be  $<0.5$  ml. Platelet increment in a patient is influenced by the transfused dose of platelets which in turn is dependent on the platelet yield<sup>6</sup> obtaining higher platelet yield has important clinical implications: It reduces the frequency of platelet transfusions and number of donor exposures with important consequent clinical and economic advantages<sup>7,8</sup>.

It has been shown that transfusion of high yield platelet products could reduce transfusion requirements of a thrombocytopenic patient<sup>9</sup>. Single donor platelet (SDP) products, unlike pooled platelet concentrates lowers the risk of transfusion transmitted infections,

alloimmunization and febrile non-hemolytic reactions<sup>10,11</sup>. Therefore, there is now more focus on the use of SDPs than pooled platelet concentrates.

**Methodology:**

The study was undertaken at transfusion medicine department, DMCH from 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2018 The study included 350 plateletpheresis procedures. Donors were selected based on following criteria:

**Selection criteria were**

- Weight > 50 Kg
- Age 18-65 years
- Hemoglobin > 12.5 gm/dl
- Platelet count >1.5 lac/ il.

A gap of eight weeks from the last whole blood donation /three days from last plateletpheresis

- No intake of non-steroidal anti-inflammatory
- Drugs in the last 36 hours.
- Absence of any illness.  
ABO identical donor for the patient.
- Negative serology for HIV, HBsAg, HCV, Syphilis and Malaria.

- Thus, a thorough history was taken and samples were collected for complete blood count as well as for Transfusion Transmitted Infection (TTI) testing. Samples from donor were evaluated for haemoglobin (Hb), total leukocyte count (TLC), haematocrit and platelet indices (count, MPV, PDW) on an automated analyzer (Micros 60, Biomeriux).

Other donor variables such as age, gender, weight and height were also documented. The donor blood should be cross match with patient’s blood. Before each procedure was undertaken Informed consent was obtained from donors. The plateletpheresis procedure were performed using MCS plus Hemonetics intermittent flow cell separator.

**Result:**

During the study period, 350 plateletpheresis donors were studied. 256 donors were in the age group of 18-30 years; 93 donors were in 31-50 years age group; 02 donors were in 51-65 years age group; Their mean age was  $28 \pm 8.06$ .

All of the donors were male. Female donors were rejected due to low hemoglobin, difficulty in obtaining venous access because of lack of prominent veins and increased subcutaneous fat. Mean body weight of donors was  $68.26 \pm 10.21$

The age, height, weight and haematological parameters of healthy donors is enlisted in Table-I.

**Table-I**  
Background information of donor

Parameter	Range	Mean±SD
Age	18-52	28±8.06
Height (cm)	150-188	168.47 ±6.07
Weight (kg)	50-108	68.26±10.21
Hb (g/dl)	12.0-16.7	14.03±1.63
HCT	38.0-54.2	43.80±3.22
Platelets ( $10^3/\mu\text{l}$ )	150-437	275±53.84

Table-II Shows statistical significant negative correlation was seen between pre donation Hb concentration and the platelet yield ( $p = 0.005$ ).

Out of 350/173 donors (49.42%) had Hb > 14 gm/dl and 350/177 (50.57%) had Hb < 14 gm/dl.

Only 84 /173 (48.6%)of donors with pre donation Hb > 14 gm/dl had yield  $>3 \times 10^{11}/\mu\text{l}$  and 108 /177(61.0%)of donors with pre donation Hb <14 gm/dl had yield  $>3 \times 10^{11}/\mu\text{l}$ .

Table-III Shows correlation between pre-donation platelet count and the yield of platelets in SDP. The mean platelet yield of all procedures was  $3.49 \pm 0.51$ . shows a direct correlation between pre-donation platelet count and the yield ( $p = 0.000$ ).

The yield was  $>3.5 \times 10^{11}$  in  $>84.1\%$  of procedures when the pre-donation platelet count was  $>300 \times 10^3/\mu\text{l}$

However, no statistical significance was seen height ( $p=0.0933$ ), weight ( $p=0.760$ ) of donor on platelet yield in our study.

**Table-II**

*Correlation of pre-donation donor Hb with yield*

Platelet yield ( $10^{11}/\text{unit}$ )	*Percent of HB (g/dl) of donor		
	Hb<14	Hb >14	Total
< 2.5	4.0 (7)	10.4 (18)	7.1 (25)
2.5-3.5	35.0 (62)	41.0 (71)	38.0 (133)
>3.5	61.0 (108)	48.6 (84)	54. (192)
N (Number of donor)	177	173	350

\* Correlation between Hb and Platelet yield is 0.151. There is Negative correlation between them. ( $p$ -value 0.005)

**Table-III**

*Correlation of pre-donation donor platelet count with yield*

Platelet yield( $10^{11}/\text{unit}$ )	*Percent of pre-donation platelet count of donor			
	<250	250-300	>300	Total
< 2.5	20.5 (25)	0.0 (0)	0.0 (0)	7.1 (25)
2.5-3.5	63.9 (78)	32.2 (37)	15.9 (18)	38.0 (133)
>3.5	15.6 (19)	67.8 (78)	84.1 (95)	54. (192)
N (Number of donor)	122	115	113	350

\*Correlation between Pre-donation platelet count and Platelet yield is 0.586. There is positive correlation between them. ( $p$ -value 0.000)

**Table-IV**

*Linear Regression model of pre-donation donor background variable with yield*

Dependent variable	Coefficient	Standardized coefficient	P-Value
Age	0.003	0.075	0.211
Sex	0.284	0.114	0.057
Weight	-0.001	-0.019	0.760
Height	0.000	0.005	0.933
Pre-donation platelet count	0.267	0.521	0.000
HCT	-0.016	-0.030	0.627
Hb	-0.034	-0.080	0.202

**Discussion:**

Platelet yield which is a measure of quality of SDP, affects platelet recovery in the patients requiring platelet transfusion.

According to the American Association of Blood Banks (AABB),<sup>12</sup> 75% of the SDP must contain  $73 \leq 10^{11}$  per unit while the European guidelines<sup>13</sup> recommend a platelet count  $72 \leq 10^{11}$  per unit.

We found in our study that pre-donation platelet count has significant linear correlation with the platelet yield ( $r = 0.4253$ ,  $p < 0.001$ ).

Higher platelet yield is obtained in donor with high platelet count because more platelets are available for collection.

Various studies have demonstrated that the platelet yield is predominantly dependent on the donor platelet count<sup>14,15,16</sup>.

Our results are also in agreement with these observations. There was a direct correlation between the platelet yield and the pre-donation platelet count ( $r = 0.50$ ,  $p < 0.001$ ).

Goodnough et al., studied 708 plateletpheresis procedures performed on 533 donors having mean pre-donation platelet count of  $237 \pm 49 \times 10^3/\text{il}$  which resulted in platelet product with mean yield of  $4.24 \pm 1.1 \times 10^{11}$ .

A direct linear correlation was observed with all the procedures<sup>17</sup>

Another donor factor that may have an influence on the platelet yield is the pre-donation Hb concentration of the donor.

Pre donation Hb is another significant factor that influences platelet yield. Present study reports statistically significant negative correlation with pre donation Hb and platelet yield ( $p=0.003$ ).

Statistical significant negative correlation was seen between pre donation Hb concentration and the platelet yield ( $p =0.003$ ). There was a trend that a donor with lower Hb concentration gave a comparatively higher platelet yield.

**In our study**

Out of 350/173 donors (49.42%) had Hb > 14 gm/dl and 350/177 (50.57%) had Hb < 14gm/dl [Table-II].

Only 84/173 (48.6%) of donors with pre donation Hb > 14gm/dl had yield  $>3 \times 10^{11}/\text{il}$  And 108/177 (61.0%) of donors with pre donation Hb < 14 gm/dl had yield  $>3 \times 10^{11}/\text{il}$

Guerrero-Rivera et al., also demonstrated an inverse relationship of Hb with platelet yield ( $r=0.554$ )<sup>18</sup> This can probably be due to higher plasma volume processed in donors with low Hb concentration thereby giving a higher platelet yield. We also studied the effect of donor clinical variables such as gender, age and weight on yield.

No significant correlation was observed between age, height and weight on platelet yield. ( $p > 0.005$ ) Similar results were seen by Buchholz et al.,<sup>19</sup> and Chaudhary et al.,<sup>20</sup>

**Conclusion:**

Platelet recovery in the patient is influenced by the transfused dose of platelets, which in turn is dependent on the quality of the platelet product in terms of yield. It has been shown that transfusion of high yield platelet products could reduce transfusion requirements of a thrombocytopenic patient.

Machine and donor related parameters usually affect platelet yield in SDP. Identification of donors factors may help in selecting donors to obtain higher platelet yields in shorter time and consequently better clinical outcome.

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