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# EFFECT OF DONOR PREDONATION VARIABLES ON THE QUALITY OF SINGLE DONOR PLATELETS

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| **Reema Bhushan*** | Assistant Professor, Department of Pathology, Gajra Raja Medical College, Gwalior, Madhya Pradesh *Corresponding Author |
| **Anita Arya** | Medical Officer, Blood Centre, Department of Pathology, GRMC and JA Hospital, Gwalior, Madhya Pradesh |
| **Neeraj Pancholi** | Demonstrator, Department of Pathology, Gajra Raja Medical College, Gwalior, MadhyaPradesh |
| **Rakesh Baghel** | Medical Officer, Blood Centre, Department of Pathology, GRMC and JA Hospital, Gwalior, Madhya Pradesh |

**ABSTRACT** **Introduction:** Plateletpheresis is as important aspect in the blood banking. Its quality is determined by the platelet yield (that is platelet count of the single donor platelet/SDP product). **Materials and Methods:** In the present study, complete blood count (CBC) parameters of donors were studied and influence of these parameters on the yield of the SDP was analysed. **Results:** The most consistent parameter found to influence the platelet yield was platelet count of the donor. Healthy donors with high platelet counts can yield better platelet yield in SDPs in a shorter time and therefore improve the clinical outcome in patients. **Conclusion:** Haematological characteristics of the donors needed to be studied to ensure a good quality of the plateletpheresis.

**KEYWORDS :** Donor, Quality, Single Donor Platelets, Plateletpheresis

## INTRODUCTION

Platelet transfusions are indicated in patients with thrombocytopenia and those who are suffering from platelet dysfunctions, with bleeding manifestation or at increased risk of bleeding. Platelets for transfusion are provided by platelet concentrates from either whole blood donation or by apheresis i.e., single donor platelets (SDP). The quality of the SDP is determined by the platelet yield (that is platelet count of the SDP product). Donor haematological parameters might affect the platelet yield. Analysis of the influence of these parameters can be of help to the blood bank personnel to effectively make a selection of the appropriate donor for plateletpheresis in the benefit of the patient. SDP with a good platelet yield would prolong the interval between subsequent platelet requirement to the patient. The aim of the study was to analyse the complete blood count (CBC) parameters in apheresis donors and to assess if they have any influence on the yield of the SDP.

## MATERIALS AND METHODS

A prospective observational study was conducted in the Blood Bank, Department of Pathology, Gajra Raja Medical College and JA Group of Hospitals from May 2022 to October 2023. All the apheresis donors satisfying the criteria pertaining to apheresis procedure were included in the study. Donors <18 years of age and more than 60 years of age were excluded from study. Informed consent was obtained from all the donors after explaining the procedure. Physical examination, donor history questionnaire, and testing of transfusion transmissible infections (TTI) was done before each procedure. Donors with platelet count more than 1,50,000/μL in peripheral blood were selected. The antecubital vein was used for access. The procedure was automated and plateletpheresis was done on Haemonetics Blood cell separator MCS: Multicomponent collection system + with single needle. Blood flow rate was maintained at 60–90 ml/ min with anticoagulant: blood ratio of 1:12. The target yield was set in the machine beforehand. At the end of the procedure, the machine calculated and gave the platelet yield (estimated platelet yield) of the SDP unit (using the donor's parameters which were feeded in the machine beforehand i.e., haematocrit, platelet count, height, and weight). The platelet count of the product ("true platelet yield" or "absolute platelet count" or "platelets per bag") was also calculated during the study. Sample from each bag was further collected in EDTA Vial (ethylenediaminetetraacetic acid vial) using the attached tube segment with the kit. After thoroughly mixing this sample, complete blood count parameters were evaluated in haematology analyser. The red blood cell (RBC) count and platelet count of the product were noted. The absolute platelet count was then calculated by the formula:

Absolute platelet count/True platelet yield = SDP volume (ml) × Platelet count obtained by Haematology analyser (platelets/μL) × Conversion factor (1000).

The donor variables including age, sex, weight, height, blood group and haematological variables i.e. haemoglobin, haematocrit, RBC count, mean corpuscular volume, red cell distribution width (RDW), platelet count, mean platelet volume (MPV), platelet distribution width (PDW) was recorded for each donation. The SDP parameters such as physical appearance, processing time, number of cycles, volume of blood processed, volume of the SDP product, and the amount of acid citrate dextrose (ACD) anticoagulant used was also noted. The RBC count and leukocyte count of the product was also analysed. CBC parameters, their mean value and relationship between the predonation donor variables and yield of platelets (absolute platelet count) were studied. The estimated yield was compared with the absolute platelet count. For all statistical tests, probability value; $P < 0.05$ was considered as statistically significant.

## RESULTS

Plateletpheresis was done in a total of 60 donors during the study period. All the donors were first time donors. All the donors were males. Maximum number of donors belonged to the age group 25-35 years. The most common blood group was B positive (49%). Maximum donors had weight between 70 and 79 kg and height between 169-179 cm. The body mass index (BMI) of the donors varied from 20.0 to 35.9 kg/m$^2$ with a mean of 25.6 kg/m$^2$. Table 1 mentions the average CBC parameters of the donors along with their correlation with platelet yield.

**Table 1: Average complete blood count parameters and their correlation with platelet yield**

| CBC parameter | Mean value | P-value (correlation with platelet yield) |
|---|---|---|
| Platelet count | 2.55 X 1011 | <0.001 |
| PDW (platelet distribution width) | 14.8fl | 0.026 |
| MPV (mean platelet volume) | 10.8fl | 0.047 |
| Haemoglobin | 14.6g/dl | 0.588 |
| Haematocrit | 45% | 0.887 |
| RBC Count | 5.5 X1012 | 0.912 |
| MCV(mean corpuscular volume) | 89.4fl | 0.698 |
| RDW(red cell distribution width) | 41.6fl | 0.833 |

The platelet count of the donors ranged from 1.5 lacs/mm$^3$ to 4.5 lacs/mm$^3$. The mean platelet count of the donors was 2.55 lacs/mm$^3$. The mean haemoglobin level was 14.6 g/dl and the mean haematocrit was 45%. The volume of the SDP product ranged from 90 ml to 316 ml (mean = 216 ml). The mean duration of the procedure was 55 min.

None of the products showed any evidence of RBC contamination and appeared clear on physical examination. The target yield was set at an average of $3.08 \times 10^{11}$ platelets/bag and ranged from 1 to $4.1 \times 10^{11}$ platelets/bag. The absolute platelet count of the bag calculated manually ranged from 1 to $4.3 \times 10^{11}$ platelets (average 3.5). A significant correlation was seen between the target yield, the estimated yield, and the absolute platelet count ($P < 0.05$). The correlation of predonation platelet count and the platelet yield was significant ($P < 0.05$). The correlation between the platelet parameters like MPV and PDW and the platelet yield was significant ($P < 0.05$). The haemoglobin, haematocrit, RBC count, and RDW showed no correlation with the platelet yield. Moreover, the amount of ACD anticoagulant used, volume of blood processed, number of cycles, and the processing time did not affect the platelet yield. Inverse relationship of the haemoglobin with the platelet yield was in the present study.

## DISCUSSION

Success of transfusion of platelets depends on the rational use of platelet product. SDP clearly meet the issues of quality and safety in transfusion as compared to random donor platelets (RDP). SDP also reduces the risk of exposure of transfusion transmissible infections, alloimmunization, and febrile nonhemolytic transfusion reactions. The amount of platelet recovery depends upon the transfused platelets count. Hence, the platelet yield is important. The number of platelets in SDP is equivalent to 6–8 RDP concentrates (Random Donor Platelets). According to the AABB (American Association of Blood Banks), 75% of the SDP should contain equal to or more than $3 \times 10^{11}$ platelets per unit[1] while the European guidelines recommended that a unit of SDP should carry platelet count $\geq 2 \times 10^{11}$ per unit[1,2].

The average platelet yield in many previous studies ranged from $2.29 \pm 0.43 \times 10^{11}$ per unit to $3.39 \pm 0.88 \times 1011$ per unit[3,4,5,6]. Some studies have reported a negative correlation between donor age and platelet yield and a positive correlation with the BMI and platelet yield[4,5,6]. These studies quoted that those having more body weight have more blood volume available for processing which in turn influences the yield. Bahadur *et al*, however, reported no significant statistic correlation between the height and weight and the platelet yield[7]. Similarly, no correlation was observed between the gender, age, weight of the donor with the yield in another study[3]. The current study also found no correlation with the age, height, weight, and BMI of the donor with the quality of SDP. Some studies have reported that Rh-negative donors had longer processing time than Rh-positive donors[8,9]. However, no such correlation was found in the present study. Most of the studies have reported a direct relationship between the platelet count and yield[3,8,9,10,11,12,13]. Goodnough *et al*. reported a mean platelet count of $237 \pm 49 \times 10^3$ and mean yield of $4.24 \pm 1.09 \times 10^{11}$ platelets in his study[13]. Patel *et al*. found that platelet yield correlated negatively with the MPV, PDW, and platelet-large cell ratio[5]. The explanation mentioned was that smaller platelets are collected more efficiently by automated cell separators and yielded a better-quality product. A donor with higher haemoglobin level was found to have a lower platelet yield[3,14,15]. Inverse relationship of the haemoglobin with the platelet yield was in the present study which can be because of the higher plasma volume processed in donor with low haemoglobin concentration. However, some studies have noticed no correlation between the donor haemoglobin concentration and yield[3,8]. Similarly, no significant correlation between haematocrit and the platelet yield was observed in some studies[12]. The RBC count and leukocyte count of the product were found to have an inverse significant correlation with the platelet yield. Higher leukocyte and RBC counts meant contamination, hence lower the yield. Studies done previously have reported that platelet yield depends mainly on the donor's blood volume before apheresis and on the volume of the blood processed[16]. Lasky *et al*. reported that the yield was related to the number of cycles[17]. Mangwana et al reported that larger yield was obtained when the separation is done in shorter time[9]. Some studies revealed that the platelet yield can be increased by increasing the processing time, the ACD infusion rate, or the volume of the plasma obtained[8,14]. However, none of the above factors influence the platelet yield in the present study.

## CONCLUSION

Healthy donors with high platelet counts can yield better platelet yield in SDPs, and hence can allow prolonging intervals between transfusions. Platelet transfusion therapy, will be influenced by the apheresis yield and dose which are critically dependent on donor platelet count and other donor variables.

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