Original Article

Access this article online
Quick Response Code:

Website:
www.ajts.org

DOI:
10.4103/ajts.ajts_73_22

# Quality assessment of platelet concentrates prepared by platelet-rich plasma, buffy-coat, and apheresis methods in a tertiary care hospital in South India: A cross-sectional study

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**Abstract:**

**INTRODUCTION:** In blood banking and transfusion medicine, it is of paramount importance to improve transfusion safety and provide a higher quality of product to maximize the therapeutic outcomes and minimize the risk of developing transfusion-associated complications for patients receiving a blood transfusion.

**MATERIALS AND METHODS:** This was a cross-sectional study conducted at the department of transfusion medicine in a tertiary care hospital of South India from February 2019 to December 2020. The primary objective of the study was to assess the quality of platelet concentrates (PC) prepared by platelet-rich plasma (PRP), buffy-coat (BC), and apheresis method. A total of 760 PCs were subjected to quality assessment, among which 124 were PRP-PC, 176 were BC-PC, and 460 were single donor platelet (SDP).

**RESULTS:** The total percentage of platelets meeting all the six quality control parameters in PRP, BC and SDP was 78.23%, 81.81%, and 89.96%, respectively. Apheresis PCs showed a significantly higher platelet concentration per µL on comparison with whole-blood-derived platelets. BC-PCs were found to be better than PRP-PC with regard to lower white blood cell (WBC) contamination ($P < 0.05$) and red blood cell (RBC) contamination ($P < 0.01$). No statistically significant difference was found with regard to platelet yield, volume, swirling, and pH.

**CONCLUSION:** *Ex vivo* quality of PCs prepared by BC-PC, PRP-PC, and apheresis-PC fulfilled the desired quality control parameters. BC-PC was better than PRP-PC in terms of lesser WBC and RBC contamination and comparable in terms of volume, platelet yield, swirling, and pH. Apheresis PCs showed a higher platelet concentration per microliter on comparison with whole-blood-derived platelets; hence in a blood center where facilities for collection of apheresis product are available, SDPs should be the choice of platelet transfusion.

**Keywords:**

Apheresis platelet, buffy-coat platelet, platelet-rich plasma platelet, quality, single donor platelet

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Submitted: 15-06-2022
Revised: 21-06-2022
Accepted: 03-07-2022
Published: 12-12-2022

## Introduction

Blood transfusion services form one of the most fundamental and crucial parts of any health-care system by providing blood components including modified products for a therapeutic and preventive purpose. The essence of safe transfusion is emphasized as "right blood, right patient, right time, and right place."[1] Recent advances in the diagnosis and treatment



**How to cite this article:** Toora E, Kulkarni RG, Manivannan P, Sastry AS, Basavarajegowda A, Sahoo D. Quality assessment of platelet concentrates prepared by platelet-rich plasma, buffy-coat, and apheresis methods in a tertiary care hospital in South India: A cross-sectional study. Asian J Transfus Sci 2023;17:239-45.

of various diseases have led to an increase in the demand for blood component therapy, especially platelet concentrates (PCs) in the form of random-donor PCs (RDPs) and single apheresis donor PCs (SDPs). The SDP has lots of advantages, but is being produced in a limited number of blood centers and is very expensive.[2] Whereas, RDPs, a low-cost product, which are prepared from whole blood by platelet-rich plasma (PRP) and buffy-coat (BC) methods, are easily available in most of the blood centers. Each method has its own advantages and disadvantages, and they differ in a few different quality control standard parameters. Our hospital being a tertiary care center utilizes a large number of platelet products prepared by all three methods for patients with cancer and hematological disorders, pediatric patients, patients undergoing organ transplant and cardiothoracic surgery, patients with infections, etc., for single and repeated transfusions. The quality control of each blood component is the most important parameter to ensure a safe and effective transfusion in the recipient; this holds good especially for the PCs as they have a very small shelf life and are stored at room temperature. The purpose of this study was to evaluate the *ex vivo* quality of PCs prepared by different methods.

## Materials and Methods

Ethical clearance was obtained from the Institutional Ethical Committee of Jawaharlal Institute Postgraduate Medical Education and Research (JIPMER), Pondicherry. The project No. being JIP/IEC/2018/414.

### Study design

This was a cross-sectional study.

### Study participants

RDPs prepared from whole-blood donations at JIPMER blood center and SDP units prepared by apheresis procedure were included in the study. RDP and SDP units discarded due to various reasons such as leakage, less volume, and reactive for transfusion-transmitted infections were excluded from the study.

Three groups were studied:

1. RDPs prepared by PRP method
2. RDPs prepared by BC method
3. SDPs prepared by apheresis.

### Sampling

#### *Sampling population*

1. RDP units prepared from whole-blood donations at JIPMER blood center and voluntary whole-blood donations at camp
2. SDP units prepared by apheresis
3. Study period: From February 2019 to December 2020.

#### *Sample size calculation*

The sample size was calculated based on the previous year's total RDP and SDP collections: 300 RDPs and 460 SDPs.

#### *Sampling technique: Systematic random sampling proportionately*

1. For RDP's sampling: Starting from each Monday (1st day of the week), every 100th RDP prepared in each method, i.e., PRP and BC, was segregated and stored till the 5th day and QC parameters for each were assessed at the end of storage. In case any sampled RDP (prepared by either method) is utilized for patient care, the shortfall was made up in the next sampling or week
2. For SDPs, all SDPs were subjected to QC assessment and samples were collected in the sampling pouch provided.

### Study procedure

Platelets are prepared in our blood center by three methods.

1. PRP-PC
2. BC-PC
3. Single-donor platelet (apheresis PC).

### Sample collection for random-donor platelet concentrates

Sampling was done following all aseptic precautions after stripping three times on day five of collection. Two to three ml of these sample was sent for complete blood count (CBC) in an ethylenediaminetetraacetic acid (EDTA) tube. Beckman coulter was used for the assessment of quality parameters. Entire RDP bag was sent for 14 days TG medium/BHI culture on day 5.

### Sample collection for single apheresis donor platelet concentrates

Under aseptic condition, two to three ml sample was collected from sampling pouch attached to the SDP product bag. This was done on day of preparation and the sample was sent for CBC and sterility testing.

The following parameters were assessed for RDPs and SDPs (as per the DGHS guidelines)[3]

a. Swirling
b. Volume
c. Platelet count
d. Red blood cell (RBC) count
e. White blood cell (WBC) count
f. pH study
g. Sterility.

### Statistical analysis

All statistical analyses were done using SPSS version 20 (IBM Corporation Ltd. Armonk, New York, USA).

The distribution of categorical data was expressed as frequency and percentage. The continuous data such as the volume of the bag, platelet count, WBC count, pH of the bag, RBC count of the bag, and pre- and postprocedure platelet counts of the donor were expressed as mean with standard deviation (SD) or median with the interquartile range. All the statistical analyses were carried out at 5% level of significance and $P < 0.05$ was considered statistically significant.

## Results

A total of 32,699 units were collected from February 2019 to December 2020. The total number of RDPs prepared during this duration was 28,846, out of which the total number of RDP prepared using the PRP method was 12,115 (41.2%) and using BC method was 16,730 (58.8%). Among the above RDPs prepared, 1% amounting to 300 RDPs were subjected for QC; among this, 124 RDPs were prepared by the PRP method and 176 RDPs were prepared using the BC method. During the period of study duration, the total number of SDPs made were 669, out of which 460 units were included in our study. For all the PCs, volume, platelet, WBC count, RBC count, pH, and swirling were assessed. In addition to the above-mentioned parameters, RDPs were also sent for sterility check. In our blood center, we collected 350 ml of whole blood from which various components were prepared.

The volume of individual units was calculated and analyzed [Table 1 and Figure 1]. Of 124 PRP-PC units, 2 (1.61%) had volume <39 ml and 13 (10.48%) had a volume of >66 ml. 109 (87.90%) units met the desired quality control criteria of volume. Of the 176 BC-PC units, 3 (1.70%) had volume <54 ml and none had volume >70 ml. Thus, 173 (98.30%) units met the desired quality control criteria volume. Of the 460 SDP units, 3 (0.65%) had volume <200 ml and the rest 457 (99.35%) units met the desired quality control criteria. The coefficient of variation (C. V.) of PRP-PC was higher, thereby showing more variation in the units adhering to the volume parameter in comparison to BC-PC and SDP. The mean volumes among PRP-PC and BC-PC were comparable ($P > 0.05$). On comparing the maximum number of units satisfying volume criteria for each method, a statistically significant difference was seen in the number of units meeting the quality criteria of volume between PRP-PC and BC-PC ($P < 0.05$); PRP-PC and SDP ($P < 0.01$) whereas no statistically significant difference was seen in the number of units satisfying the SDP and BC-PC ($P > 0.05$).

The platelet count of individual units was calculated and analyzed. The distribution of different PC's based on yield, and platelet count per microliter and mean ± SD, range, CV, and percentage of PCs meeting Quality parameter for yield. On comparison of Platelet yield [Table 2 and Figure 2], the maximum number of units satisfying the quality criteria for platelet yield, a statistically significant difference was found between SDP and PRP-PC ($P < 0.01$); SDP and BC-PC ($P < 0.01$), where a higher number of units met the QC criteria in SDP. whereas the number of units satisfying the QC among PRP-PC and BC-PC was comparable ($P > 0.05$). The mean platelet yield per microliter between PRP-PC

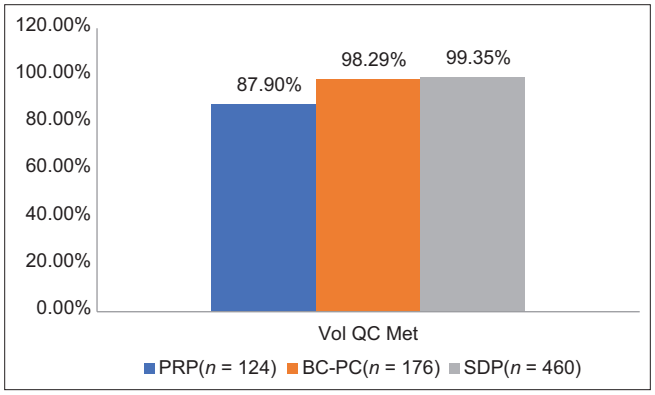


**Figure 1:** Percentage of PC's meeting quality parameters for volume. PC's = Platelet concentrates

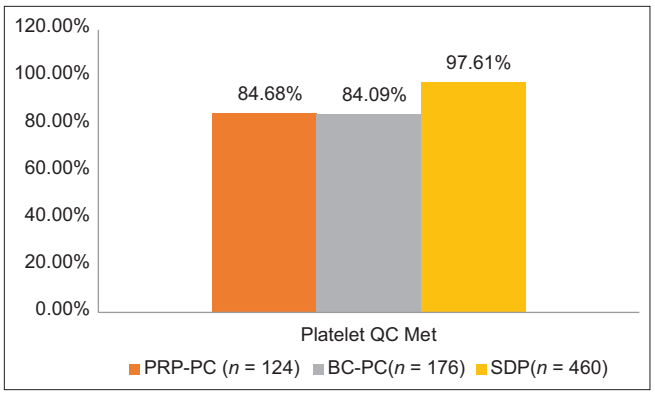


**Figure 2:** Percentage of PC's meeting quality parameters for yield. PC's=Platelet concentrates

**Table 1: Mean±standard deviation, range, CV, and percentage of platelet concentrates meeting quality parameter for volume**

| Methods | Volume (mean±SD) | Range | CV | Vol QC met, *n* (%) | Vol QC fail, *n* (%) | *P* |
|---|---|---|---|---|---|---|
| PRP (*n*=124) | 59.48±6.84 | 30-75 | 0.115 | 109 (87.90) | 15 (12.1) | >0.05 (PRP vs. BC) |
| BC-PC (*n*=176) | 60.59±3.29 | 42-69 | 0.054 | 173 (98.29) | 3 (1.1) | |
| SDP (*n*=460) | 395.04±32.72 | 116-441 | 0.083 | 457 (99.35) | 3 (0.65) | |

PC=Platelet concentrate, SD=Standard deviation, PRP=Platelet-rich plasma, BC-PC=Buffy-coat PC, SDP=Single donor platelet, CV=Coefficient of variation

and BC-PC was comparable ($P < 0.01$) whereas SDP showed a higher value compared to PRP ($P < 0.05$) and BC-PC ($P < 0.05$). CV of BC-PC, PRP-PC significantly higher than that of SDP-PC showing more variation in units adhering to the platelet count parameter.

WBC count of individual units was calculated and analyzed as mean ± SD or median with inter-quartile range (IQR). Table 3 and Figure 3 depicts the distribution, mean. Range and percentage of units meeting QC criteria for different PC's. On comparison of the maximum number of units satisfying the quality criteria for WBC count, a statistically significant ($P < 0.05$) difference was found between all the types of PC's where the maximum number of units meeting QC was seen by SDP followed by BC-PC than PRP-PC. On comparison of WBC contamination per bag statistically significant difference between PRP-PC and BC-PC was seen, BC-PC showing 1 log reduction, thereby lesser WBC contamination. CV indicates higher variation in BC-PC, PRP-PC compared to SDP which showed lower variation.

RBC count of individual units was calculated and analyzed as median with IQR. Table 4 and Figure 4 depicts the distribution, mean. Range and percentage of units meeting QC criteria for different PCs. On comparison of the maximum number of units satisfying the quality criteria for RBC count, a statistically significant ($P < 0.05$) difference was found between PRP-PC and SDP; PRP-PC and BC; whereas SDP and BC-PC were comparable ($P > 0.05$). On comparison of RBC, contamination per bag statistically significant difference between PRP-PC and BC-PC was seen, BC-PC

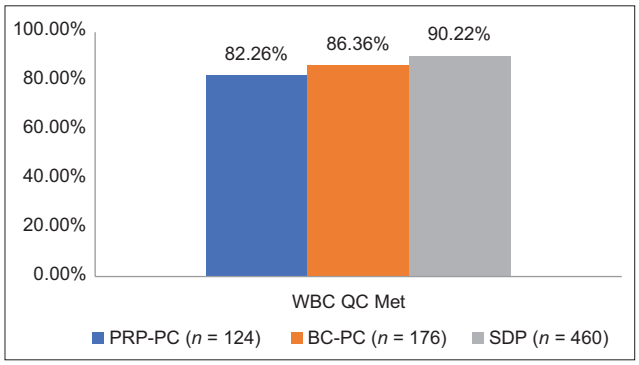


**Figure 3:** Percentage of PC's meeting quality parameters for WBC count. PC's = Platelet concentrates

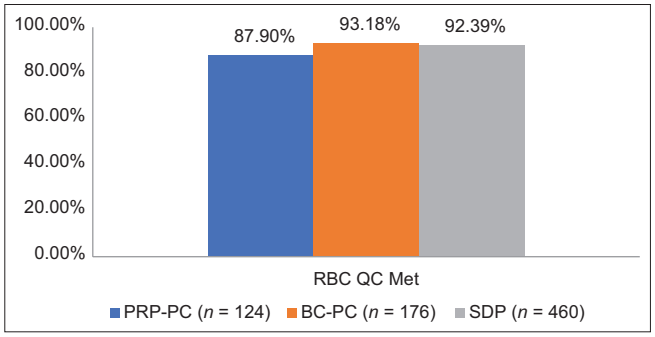


**Figure 4:** Percentage of PC's meeting quality parameters for RBC count. PC's = Platelet concentrates, WBC = White blood cell

**Table 2: Mean±standard deviation, range, CV, and percentage of platelet concentrates meeting quality parameter for yield**

| Method | Platelet count per unit (mean±SD) ($\times10^{10}$/unit) | Range ($\times10^{10}$/unit) | CV | Platelet QC met, *n* (%) | Platelet QC fail, *n* (%) | *P* |
|---|---|---|---|---|---|---|
| PRP-PC (*n*=124) | 4.48±1.34 | 1.3-9.8 | 0.299 | 105 (84.68) | 19 (15.14) | >0.05 (PRP vs. BC) |
| BC-PC (*n*=176) | 4.57±1.25 | 0.80-8.7 | 0.274 | 148 (84.09) | 28 (15.91) | |
| SDP (*n*=460) | 57±11 | 0.78-9.38 | 0.193 | 449 (97.61) | 11 (2.39) | |

PC=Platelet concentrate, SD=Standard deviation, PRP-PC=Platelet-rich plasma PC, BC-PC=Buffy-coat PC, SDP=Single donor platelet, CV=Coefficient of variation

**Table 3: Mean±standard deviation, range, CV, and percentage of platelet concentrates meeting quality parameter for white blood cell count**

| Method | WBC count per unit (mean±SD)/IQR | Range | CV | WBC QC met, *n* (%) | WBC QC fail, *n* (%) | *P* |
|---|---|---|---|---|---|---|
| PRP-PC (*n*=124) | 290 (41.5-500) | 0.41-790 | 0.705 | 102 (82.26) | 22 (17.74) | <0.01 (PRP vs. BC) |
| BC-PC (*n*=176) | 3.3 (2.9-4.6) | 1.2-980 | 4.805 | 152 (86.36) | 24 (13.64) | |
| SDP (*n*=460) | 4.42±0.92 | 1.6-12 | 0.187 | 415 (90.22) | 45 (9.78) | |

PC=Platelet concentrate, WBC: White blood cell, SD=Standard deviation, PRP-PC=Platelet-rich plasma PC, BC-PC=Buffy-coat PC, SDP=Single donor platelet, IQR=Interquartile range, CV=Coefficient of variation

**Table 4: Mean±standard deviation, range, CV, and percentage of platelet concentrates meeting quality parameter for red blood cell count**

| Method | RBC IQR counts per unit | Range | CV | RBC QC met, *n* (%) | RBC QC fail, *n* (%) | *P* |
|---|---|---|---|---|---|---|
| PRP-PC (*n*=124) | 0 (0-0.26) | 0-0.77 | 1.574 | 109 (87.90) | 15 (12.1) | <0.01 (PRP vs. BC) |
| BC-PC (*n*=176) | 0 (0-0) | 0-0.68 | 3.083 | 164 (93.18) | 12 (6.82) | |
| SDP (*n*=460) | 0.352 (0.351-0.362) | 0-0.88 | 0.393 | 425 (92.39) | 35 (82.39) | |

PC=Platelet concentrate, RBC: Red blood cell, PRP-PC=Platelet-rich plasma PC, BC-PC=Buffy-coat PC, SDP=Single donor platelet, IQR=Interquartile range, CV=Coefficient of variation

having lesser RBC contamination. C. V. shows high variations in BC-PC, PRP-PC methods while SDP-PC has the lowest variation of RBC contamination.

All the 760 units were analyzed for pH and were found to satisfy the QC. The overall mean pH of all the PCs was 6.66 ± 0.35 (mean ± SD). SDP-PC showed better adherence to the physiological pH values. Swirling was observed in every individual unit and graded 0–3 according to subjective observation. Figure 5 provides the swirling Grades of the methods. Among the 8 PRP-PCs and all the 9 BC-PCs, showing Grade 2 swirling had a lower platelet yield (<3.5 × 10 10). A total of 300 RDPs were sent for sterility testing. 1 PRP (0.33%) unit had shown growth of *Serratia marcescens* after 14 days of incubation.

For each QC parameter met 1-grade score was given to that unit. We have evaluated for 6 QC parameters viz-Volume, PC count, WBC, RBC, pH, swirling. Hence each unit can score a minimum of 0 score and a maximum of 6 score. Table 5 depicts the scoring of the PCs. It is seen that SDP units achieved a higher final score compared to BC and PRP PC.

## Discussion

This cross-sectional study was conducted with an aim to assess the quality of platelets prepared by different methods. PCs available for transfusion are broadly of two types RDP prepared from whole blood and SDP prepared by plateletpheresis. RDPs as described earlier are made by two methods i.e., PRP and BC. There is an ongoing debate whether PCs prepared from either whole-blood donations or by plateletpheresis are superior. In our study we found that >75% of the products tested for various QC parameters were within the acceptable range, this was in concordance as per drugs and cosmetic act which states that >75% of the products tested should meet the specified quality parameters.

**Table 5: Scoring of platelet concentrate's prepared by platelet-rich plasma, buffy-coat, and single apheresis donor platelet**

| Scoring | PC prepared by different methods | | |
|---|---|---|---|
| | PRP-PC (*n*=124), *n* (%) | BC-PC (*n*=176), *n* (%) | SDP (*n*=460), *n* (%) |
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 3 (2.42) | 2 (1.14) | 1 (0.22) |
| 4 | 10 (8.06) | 10 (5.68) | 7 (1.52) |
| 5 | 14 (11.29) | 20 (11.36) | 52 (11.30) |
| 6 | 97 (78.23) | 144 (81.81) | 400 (89.96) |
| Total | 124 (100.00) | 176 (100.00) | 460 (100.00) |

PC=Platelet concentrate, PRP-PC=Platelet-rich plasma PC, BC-PC=Buffy-coat PC, SDP=Single donor platelet

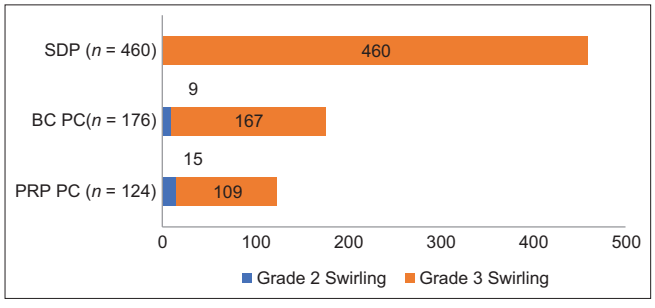


**Figure 5:** Swirling observed in different platelet concentrates

Our PRP and SD*P* values were comparable to Talukdar *et al*.,[4] other studies there was a variation in the volume as Mallhi *et al*.,[5] Singh *et al*.[6] made PC from WB collection of 450 ml whereas Hirosue *et al*.,[7] Fijnheer *et al*.[8] prepared RDPs from WB collection of 400 ml. Among 124 PRP-PC units, 2 had volume <39 ml while 13 units had a volume of >66 ml. This can be explained as the PRP method of preparation involves manual expression of plasma, factors like undertrained staff, over/under-expression of plasma that can impact the final volume. Of the 176 BC-PC units, 3 had volume <54 ml and none had volume >70 ml. BC method of PC preparation involves automated expression of plasma where the plasma is expressed out based on the dry and wet buffy weight set into the Terumo-BCT and the sensors hence the volume of the final PC is more consistent and most of them meet the appropriate quality criteria Coefficient of variation (C. V.) of PRP-PC (0.115) was higher compared to BC-PC (0.054). The BC-PC showed better adherence to volume parameters compared to PRP-PC. The volume among PRP-PC and BC-PC were comparable. Similar findings were observed by Hirosue *et al*.,[7] Fijnheer *et al*.,[8] and Talukdar *et al*.,[4] in their study. Among the 460 SDP's subjected to quality assessment, 3 SDP had volume <200 ml. this was because of various procedure-related complications like low draw pressure, double prick, hematoma, vasovagal reaction, in one of the procedures the donor had become unconscious and the procedure was aborted.

The pH is a measure of the concentrations of Hydrogen ions in a particular substance. Usually, pH tends to fall during storage depending on the stabilizer used in the plastic platelet storage bags and storage conditions. As the pH goes below 6 platelets undergo a substantial loss of viability.[5] In our study all 790 PC's had pH >6, the mean pH was 6.39 ± 0.26, 6.27 ± 0.27 and 6.89 ± 0.16 for PRP-PC, BC-PC and apheresis PC respectively. These values were comparable to the results obtained by apheresis showed better adherence to the physiological pH values, in concordance with the findings of Mallhi *et al*.[5] pH of SDPs was measured on the day of preparation because they are made on request for oncology patients and usually get issued within 24–48 h whereas pH of RDP's

was measured on day 5 of storage. It is known that upon storage of PC's there occurs accumulation of lactic acid and drop in pH. This could explain the reason for SDP's pH being much closer to the physiologic value and the RDP's having a significant lower pH value compared to SDP.

In our study, a significant statistical difference was observed between the PRP-PC vs. SDP ($P < 0.05$) and between BC-PC vs. apheresis-PC units ($P < 0.05$) with regard to the comparison between the platelet count per unit per microliter among these groups., whereas the platelet count per unit per microliter between PRP-PC and BC-PC was found to be comparable. Yield from apheresis products is known to be higher, substantiating our findings.

The mean platelet yield between PRP-PC and BC-PC were comparable. A study done by Mallhi *et al*.,[5] Singh *et al*.[6] and Chaudhary *et al*.,[9] also showed similar findings between the platelet yield of PRP-PC and BC-PC. Individual preparation methods can *per se* affect the platelet function due to various lesions formed during preparative manipulation and storage. Contrary to the findings of our study Fijnheer *et al*.[8] found 15% higher platelet yield in PRP-PC than BC-PC units, Hirosue *et al*.[7] also reported a higher platelet yield count in PRP-PC units than BC-PC. These were studies done in the 1990s and at that time quadruple system of blood bags was just introduced, so their protocols might not have been standardized for component separation by different methods leading to discrepant results.

In most of the studies, the mean yield is higher compared to our study due to the difference in the volume of whole-blood collection [Table 6]. The RDP's in our studies were prepared from 350 ml of whole-blood collection whereas in other studies it was prepared from WB collection of 400 ml and above. this would lead to a difference in the volume of the PCs, giving better yield for units with a higher volume. BC-PC method of platelet preparation is known to provide 1–2 log reduction and apheresis products are known to effectively bring about 3–4 log leukoreduction. In our study, we found That BC-PC units had lower WBC contamination than PRP-PC ($P < 0.05$). This was comparable with the results found in studies done by Singh *et al*.,[6] Hirosue *et al*.[7] and Fijnheer *et al*.[8] This difference is expected as there occurs removal of the buffy-coat layer in the BC platelet preparation method which leads to maximal removal of the WBC's.

On comparison of the WBC count per microliter of SDP with BC-PC not much difference was seen, similar results were observed by Talukdar *et al*.,[4] BC-PC preparation is a two-step process in which initially a buffy layer is removed and then again after 2nd spin the platelets are separated, whereas in apheresis preparation, the blood is centrifuged only once and the WBC's are trapped in the leucocyte reduction system chamber. The difference in the method of WBC removal can impact the final WBC contamination of the product. It might be possible that the newer automated blood component separators have a better WBC removal capacity, giving comparable results with apheresis product.

In our study, the mean/IQR of RBC count in PRP-PC, BC-PC, and SDP was found to be 0 (0,0.26) ranging from 0 to 1.2 ml, 0 (0–0.4) range 0–0.68 ml, 0.352 (0.351,0.362) ranging from 0 to 0.88 ml. C. V. shows high variations in BC-PC, PRP-PC methods while Apheresis-PC has the lowest variation of RBC contamination. PRP-PC units had maximum RBC contamination. PRP method of platelet preparation is a manual method and compared to automated blood separation methods there are more chances of error in PRP method. While manual expression of plasma from the PRBC layer, if not properly done can cause excess RBC's to go into the plasma from which platelets are separated after 2nd spin. So, this can lead to higher RBC contamination rate in the PC's in PRP method. We also found a higher coefficient of variation in BC-PC which suggests that a better standardization of the protocol for preparation of PC's from BC method is required. Not many studies are available which compare the RBC contamination in various platelet products.

A total of 300 RDPs were sent for sterility testing. 1 PRP unit had shown growth of *S. marcescens* after 14 days of incubation. All the other RDPs sent were found to be sterile after 14 days of incubation. *S. marcescens* is a

**Table 6: Comparison of platelet yield of different platelet concentrates in different studies**

| Studies | Location | PRP (mean±SD) $\times10^{10}$/unit | BC (mean±SD) $\times10^{10}$/unit | SDP (mean±SD) $\times10^{11}$/unit | *P* (PRP and BC) | *P* (PRP and SDP) | *P* (BC and SDP) |
|---|---|---|---|---|---|---|---|
| Our study | South India | 4.48±1.34 | 4.57±1.25 | 5.7±1.1 | >0.05 | <0.01 | <0.01 |
| Talukdar *et al*.[4] | Eastern India | 2.1±0.9 | 3.1±1.1 | 2.3±0.58 | >0.05 | <0.01 | <0.01 |
| Mallhi *et al*.[5] | Western India | - | 8.75±2.89 | 3.92±0.74 | - | - | <0.01 |
| Singh *et al*.[6] | Northern India | 7.60±2.97 | 7.30±2.98 | 4.13±1.32 | >0.05 | <0.01 | <0.01 |
| Hirosue *et al*.[7] | Japan | 7.6±1.80 | 6.21±1.51 | - | <0.01 | - | - |
| Fijnheer *et al*.[8] | Netherlands | 6.8±1.2 | 5.3±1.4 | - | <0.01 | - | - |
| Latha *et al*.[10] | South India | 5.5±0.2 | 8.2±0.7 | - | <0.05 | | |

PRP=Platelet-rich plasma, BC=Buffy-coat, SDP=Single donor platelet, SD=Standard deviation

gram-negative enterobacterium, it is an opportunistic pathogen known to cause nosocomial infections associated with different kinds of medical equipment like ultrasonic nebulizers, mechanical ventilators, intravenous fluids, intravenous catheters, etc., Szewzyk *et al*., on the investigation of an outbreak of *S. marcescens* found the source to be from the packages of blood bags.[11] During the assembly of the blood bags at the manufacturing site, when bags are autoclaved and cooled, moisture is generated which can harbour organisms. Defects in the blood bag or any leakage can also cause moisture on the surface to go into the bag leading to contamination.

In our study, the report of the RDP being culture-positive had come after 14 days, by that time the corresponding PRBC and FFP unit were already transfused to patients. We had identified the patients and asked for details from the concerned ward regarding any history of transfusion reaction, none of them developed any transfusion reactions. The donor was called back and asked for any signs of infection or illness which he had not revealed during the screening procedure, but the donor assured that he was healthy and had no co-morbidities.

## Conclusion

Present study shows *ex-vivo* quality of PCs prepared by BC-PC, PRP-PC, and Apheresis-PC fulfilled the desired quality control parameters. Apheresis PCs showed higher platelet concentration per microlitre on comparison with whole-blood-derived platelets, hence in blood center where facilities for collection of apheresis product is available, SDP's should be the choice of Platelet transfusion. BC-PC was better than PRP-PC in terms of lesser WBC and RBC contamination and comparable in terms of volume, platelet yield, swirling and pH. In our study also, only the *ex vivo* quality parameters of PCs were assessed. In order to know the *in vivo* performance of the platelets future studies should be planned with a broader inclusion of criteria like CCI and percentage platelet recovery.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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