ORIGINAL ARTICLE

Differences in The Number of Platelets Before and After Being Processed in the Blood Donation Unit of the Indonesian Red Cross in Lumajang Regency

Mariana Asmaningdiah[1], Arabella Voniasari[1], Stevani Florentia Bahi[1], *Theresia Indah Budhy[2,3], Fasih Nur Fauziah[4,5], Hupitoyo Hupitoyo[5]

[1] Master of Immunology Study Program, Postgraduate School, Universitas Airlangga, Surabaya 60285, Indonesia
[2] Department of Immunology, Postgraduate School, Universitas Airlangga, Surabaya 60285, Indonesia
[3] Department of Oral and Maxillofacial Pathology, Faculty of Dental Medicine, Universitas Airlangga, Surabaya 60286, Indonesia
[4] Blood Donation Unit of Indonesian Red Cross in Lumajang Regency, Lumajang 67314, Indonesia
[5] Associate Degree of Blood Bank Technology, Department of Applied Health Science, Polytechnic of Health Malang, Malang 65119, Indonesia

ABSTRACT

Introduction: The quality of the platelet concentrate is influenced by the number of platelets in it, because a high platelet count is required for the treatment of the patient. The manufacturing process is carried out by centrifugation. Centrifugation is a process used to convert whole blood into platelets, which can increase the number and concentration of platelets. Therefore, this study aims to determine the difference in the number of platelets counted before and after processing. **Material and Methods:** Samples were taken 4 every month from January to August 2020 using the probability sampling method. So the number of samples used is 32. Processing into concentrated platelets using the centrifugation method **Results:** Platelets count before treatment was 305,69/µl of blood with a minimum of 281,000/µl and a maximum of 355,000/µl and standard deviation of 19,544. After processing, mean platelet count of 1,067, 31/ µl, Minimum 978,000/ µl, and a maximum of 1,218,000/ µl and standard deviation of 65,863 was obtained. the data were tested for normality using Kolmogorov-Smirnov, the results were 0.060 and the posttest data was 0.179. This shows that the data is normally distributed because the result is > 0.05. Then a paired T test was carried out with the result of 0.000 meaning that there was a difference in the number of platelets before and after processing. **Conclusion:** The results showed that there were differences in the number of platelets before processing compared to after processing.

Keywords: Concentrated platelet products, Platelets, Platelets before and after processing, Thrombocyte, Thrombocyte concentrate

Corresponding Author:
Prof. Dr. Theresia Indah Budhy, DDS, MSc., PhD
Email: theresia-i-b-s@fkg.unair.ac.id
Tel: +62315041536, +62315041566

INTRODUCTION

Platelets are one of the blood components present in the human body, which plays an important role in the formation of blood clothing. It originate from fragmentation of the cytoplasm of megakaryocytes (1). Once platelets are formed from megakaryocytes, they remain in circulation for 5-7 days and serve mainly as regulators hemostasis and thrombosis. After trauma or injury to blood vessels, platelets become active, causing adhesion to the extracellular matrix exposed under the endothelium, the formation of platelets nodes, and finally the formation and fusion of platelets thrombosis including the nucleus and shell (2). The amount of platelets under normal conditions in the human body is 150,000 to 350,000 per microliter of blood (3).

Since platelets were first identified in 1881, there has been continuous and accelerating progress in basic understanding on its function (4). Platelets play an important role in stopping bleeding (5). Circulating platelets are naturally involved in wound healing, depending on their number in the circulating blood and the state of their activation in response to factors present in the blood. Subsequently, it is also known that plasma-rich plasma (PRP) has a positive effect on soft tissue healing (6). When a vascular injury occurs, platelets are

activated and formed at the site of the injury. The main function is to form mechanical plugs during the normal hemostatic response to vascular injury. Blood stored for more than 24 hours does not contain any functional platelets or large amounts of coagulation factors V and VIII. Without platelets, spontaneous leakage of blood can occur through small blood vessels. Its reactions in the form of adhesions, secretions, aggregations and fusions and their coagulation activity are important for their functioning (7). Additionally, PRP pregnant GF important is involved in cell maturation, differentiation, Angiogenesis and increased collagen production (6). Due to its function, platelets are very important for an individual going through major surgery, such as organ transplantation or cancer surgery. Therefore, it is important for an individual to always keep blood platelet levels at a normal level in order to avoid various health problems.

One of the blood components produced at the Indonesian Red Cross Blood Donor Unit in Lumajang Regency is concentrated platelets, which are produced from platelet-rich plasma (2). The procedure is according to the requirements for the acceptance of platelet components as stipulated in the Regulation of the Minister of Health Number 91 of 2015. A research by Dedianto Hidajat, Diah Adriani Malik, and S. Buditjahjono in 2012 on platelet-rich plasma in dermatology Semarang reported that platelet-rich plasma for clinical treatment requires approximately 1,000,000 platelets per microliter (11). In the processing of platelets derived from PRP, a centrifugation process is required. Rachita Dhurat et al (2014) mentioned that the platelet concentration factor can be changed with the centrifugation force applied in PRP preparation(9). Therefore, the normal number of platelets in whole blood before processing must be higher compared to the numbers after processing. This research aims to determine the difference in the number of platelets before and after being processed at the Indonesian Red Cross Blood Donor Unit, Lumajang Regency.

MATERIALS AND METHODS

Samples

This research was conducted by collecting secondary data at the Indonesian Red Cross Blood Donation Unit in Lumajang Regency. The number of samples was determined based on the provisions stated in the Minister of Health Regulation No. 91 Year 2015 regarding the number of platelet products that must be checked every month, which is at least 4 bags per month (8) from January 1st to August 31st, 2020 using probability sampling technique. Therefore, the number of samples used was 32.

Method of processing whole blood into platelet concentrate

Processing of whole blood into platelets concentrate was carried out by 2x playback in refrigerated centrifuge. Subsequently, the first procedure carried out was the preparation of PRP, whole blood was rotated at a temperature of 20-24 Celsius for 13 minutes at a speed of 1300 rpm, resulting in concentrated red blood cells and platelet rich plasma (PRP). The second procedure was the preparation of platelets concentrate from PRP, rotated at a temperature of 20-24 Celsius for 15 minutes at a speed of 3000 rpm (heavy spin) resulting in generated platelets concentrate and plasma (6, 9, 10).

Plateled test method

The impedance method was used for cross examination. Mindray BC-20s is a high-quality automated hematology analyzer for in vitro diagnostic used in clinical laboratories. Additionally, it uses impedance methods for measurement of leukocyte (WBC), erythrocyte (RBC) and platelet (PLT) concentrations.

Statistical analysis

The determination of the distribution and normality of the data was carried out using Kolmogorov-Swirnov One-Sample test, tested by hypothesis testing on two unpaired groups. The tests performed are Paired T-Test for normal distribution data and the Wilcoxon test for abnormally distribution data. The confidence level used is 95%, and therefore the level of precision or inaccuracy limit is (α= 0.05).

RESULTS

The research data obtained was in the form of a pre-treatment and post-treatment platelets count in concentrated platelets conducted from January to August 2020. Pre-treatment platelets count results indicated an average platelet count of 305.69/µL blood with a minimum count of 281,000/µL and a maximum count of 355,000/µL. While the standard deviation of the pre-treatment platelets count results is 19,544 (Table I). Post-treatment platelet count results indicated a mean platelet count of 1,067,313/µl, a minimum of 978,000/µl and a maximum of 1,218,000/µl based on treated platelets counts. Meanwhile, the standard deviation of the test results of the platelet count of its concentrate samples from platelet bags was 65,863 (Table II).

From the existing data, the normality test was carried out using Kolmogorov-Smirnov, the pretest results were 0.060 and the post-test data was 0.179. This implies that the data is normally distributed because the result is > 0.05. Then a paired T test was carried out with a result of 0.000, which means that there was a difference in the number of platelets before and after processing, an examination carried out to determine the quality of platelets in the blood product.

Table I: Distribution of platelet analysis results before and after processing

No.	Month	Bag Number	Platelet Count Before Processing (x 10^3/ l)	Platelet Count After Processing (x 10^3/ l)
1	January	K1036661B	355	1193
2		K2045758B	309	1082
3		K1045776B	318	1113
4		K1045726B	307	1075
5	February	K3071301B	304	1064
6		K2071636B	324	1134
7		K5072624B	295	1033
8		K4072661B	306	1071
9	March	K4105242B	333	1166
10		K1105127B	298	1043
11		K4105150B	319	1117
12		K5105195B	330	1155
13	April	K2227734B	289	1012
14		K5228052B	292	1008
15		K2227643B	348	1218
16		K3227622B	309	1079
17	May	S2771485B	338	1183
18		S2773780B	283	991
19		S2771933B	292	1019
20		S2771774B	290	1015
21	June	S2775716B	296	1028
22		S2777586B	305	1068
23		S2779054B	326	1141
24		S2780385B	281	984
25	July	S2776759B	292	1022
26		S2779296B	287	1005
27		S2770837B	284	994
28		S2778151B	293	1026
29	August	S2770057B	283	978
30		S2768255B	301	1054
31		S2770492B	299	1047
32		S2774328B	296	1036

DISCUSSION

Based on the table, it was reported that the results of the platelets count before processing indicated an average platelet count of 305,688/µl of blood with a minimum number of 281,000/µl and a maximum number of 355,000/µl. While the standard deviation of Platelets count test results before processing was 19,544. Results of the platelet count after processing indicated an average platelet count of 1,067,313/µl of blood with a minimum number of 978,000/µl and a maximum number of 1,218,000/µl. While the standard deviation of the results of the platelet count examination of its concentrate sample from the platelet bag was 65,863. In this research, the result showed that the mean number of platelets before processing (305,688/µL) increased in number after processing (1,067,313/µL).

This research is in accordance with the study conducted by Arora et al (2015), which showed an increase in the number of platelets in PRP after processing compared to before processing. These results indicated that the platelet count of PRP contains more platelets and increases by almost 400% after processing by centrifugation (6). According to Rachita Dhurat and M.S. Sukesh in 2014 on Principles and Methods of Platelet-Rich Plasma Production: A Review of The Author and Prospects In India, this process is called fractional centrifugation mentioning that the platelets concentration factor can be changed with the centrifugation force applied in the production of PRP (9). Therefore, centrifugation, which is commonly used for processing platelets has been shown to increase its number. A research by Dedianto Hidajat, Diah Adriani Malik, and S. Buditjahjono in 2012 about platelet-rich plasma in Semarang dermatology reported that platelet-rich plasma for clinical treatment requires about 1,000,000 platelets per microliter (11). One of the processes contributing to the increase in the number of platelets in PRP is centrifugation, and the platelet products must show an increase in quantity of almost 400% compared to before treatment in order to achieve the therapeutic effect desired by the patient.

CONCLUSION

This research showed that there was a significant difference in the number of platelets from the whole blood samples in the main bags before processing compared to the number of platelet-rich plasma samples in the satellite bags after processing.

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