International Journal of Research in Medical Sciences
*Gayathri M et al. Int J Res Med Sci. 2024 Sep;12(9):3326-3330*
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20242611

**Original Research Article**

# A comparative study of platelet count by manual method and automated analyser: a retrospective study

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**Received:** 01 July 2024
**Accepted:** 14 August 2024

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## ABSTRACT

**Background:** Platelets are essential for hemostasis and preventing bleeding. They are produced in the bone marrow at a rate of about 10 per day. The normal platelet count range is 150,000 to 450,000 per microliter of blood. Accurate platelet counts are crucial for diagnosing and managing related disorders. This study aims to promote advanced technologies and improve healthcare practices, enhancing patient outcomes.
**Methods:** This retrospective study was included 199 individuals. Venous blood samples were collected in EDTA vacutainer tube for the estimation of platelet count in manual and automated method. The results were analysed using SPSS software
**Results:** The average mean values of platelet in manual method were 208080 and in the automated method was 215979. Analysis of data obtained showed that there was a statically significant differences in manual and automated method of platelet count (p values 0.011). There was Significant differences among Thrombocytopenia, Normal, Thrombocytosis were observed in manual as well in automated method with p values less than 0.001. There were no significant differences in platelet counts across age and gender groups been observed in both the methods.
**Conclusion**: The study found that the mean values of platelet in manual method was manual slightly higher compared to automated methods and showed statically significant. Additionally, there was a statistical difference between both the methods of platelet count among different patient groups However, no significant differences were observed in platelet counts based on gender or age groups.

**keywords:** Platelet count, Automated method, Manual method, Thrombocytopenia, Thrombocytosis

## INTRODUCTION

Platelets or thrombocytes are vital constituents of circulating blood which play a crucial role in maintaining hemostasis and preventing excessive bleeding.[1] They are anucleated discoid cells with small cytoplasmic protrusions.[2] They are produced in the bone marrow at a rate of approximately 1011 per day in healthy individuals. The normal range of platelet counts normally falls between 150,000 to 450,000 per microliter of blood. However, deviations from this range can lead to various platelet disorders, significantly impacting an individual's health and well-being.[3,4] Accurate estimation of PLT count is crucial in clinical practice for diagnosing and managing platelet-related disorders effectively.[5] Automated platelet analyzers offer convenience and efficiency, they may yield inaccurate results in the presence of interfering factors such as fragmented red blood cells, giant platelets, or platelet clumps. Consequently, alternative methods such as manual chamber counting and peripheral blood smear examination serve as valuable tools for validation and quality assurance.[6] This study aims to compare PLT counting methods, specifically focusing on the diagnostic efficacy of automated analyzers versus manual techniques. And it will investigate how platelet count

varies with respect to age and sex. By shedding light on the comparative effectiveness of platelet counting methodologies, this research endeavors to contribute to the advancement of diagnostic practices and the optimization of healthcare resources. Through a comprehensive analysis of PLT count determination, this study aims to facilitate the adoption of advanced technologies and foster improvements in traditional healthcare practices, ultimately enhancing patient outcomes and healthcare delivery.

## METHODS

### *Study place*

The retrospective study was conducted in Yenepoya Medical College Hospital Laboratory, Derlakatte, Mangalore over a period of one year from May 2023 to May 2024.

### *Study design*

A retrospective study was conducted on 199 subjects The data were collected by Simple random sampling technique. Venous blood samples were collected in EDTA vacutainer tube for the estimation of platelet count in manual and automated method. The automated analysis employed the sysmex XN-1000 hematological analyzer, processing 3 ml of blood per EDTA tube. In contrast, the manual venous blood was drawn into an EDTA vacutainer tube, and Leishman's stains were used to stain the sample in accordance with standard procedure. Platelet counts were represented as lacs/mm3 after the number of platelets in 10 oil immersion fields was estimated and multiplied by 15,000. The results were analysed using SPSS software. Based on the values of platelet, Patients were divided into three categories. Thrombocytopenia (platelet count less than 150×109/l), thrombocytosis (platelet count more than 450×109/l) and normal (Platelet count ranges from 150×109 to 450×109/l) and significance differences among these categories in both the method were also calculated.

### *Inclusion criteria*

All patients consulted at Yenepoya Medical college hospital for routine blood count irrespective of age and sex were included.

### *Exclusion criteria*

Clotted and hemolyzed sample in situation where patients could not be contacted for repeat sampling were excluded.

### *Statistical analysis*

The collected data were summarized by using the descriptive statistics, frequency, percentage, mean and S.D. The Paired "t" test was used to compare platelet count between manual method and automated method. To compare platelet, count according to gender; the independent sample "t" test was used. The One-way ANOVA was used to compare platelet count according to age groups as well as to compare platelet count in three groups (Thrombocytopenia, Normal platelet count, Thrombocytosis).

## RESULTS

A total of 199 patients were included in this study. Out of which 69 were females with 34.7% of the total. The remaining 130 patients were males, representing 65.3% (Figure 1).

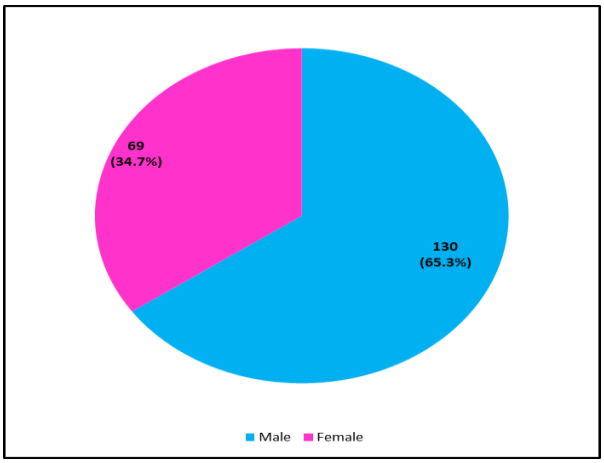


**Figure 1: Gender.**

The youngest patients were NB and oldest patients was 80years. The highest count of patients was in the age group of 41 to 60 with 41.2% and lowest count of patients was seen in the age group of NB to 20 years with 12.1% (Figure 2).

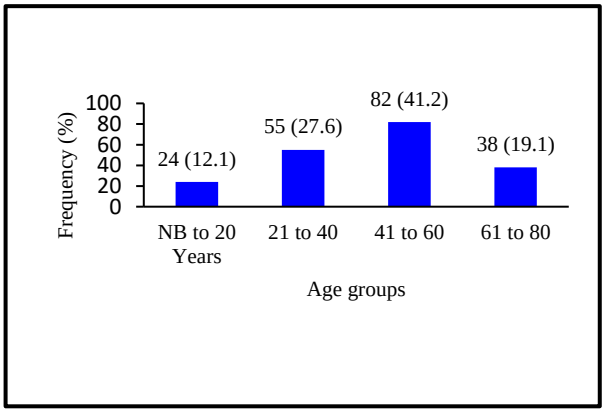


**Figure 2: Age according to the group.**

In terms of platelet count in three groups, thrombocytopenia was observed in 102 patients (51.3%), thrombocytosis in 27 patients (13.6%), and 70 patients (35.2%) had platelet counts within the normal range. (Figure 3). In the present study, A comparison of platelet

count between the manual method and the automated method was conducted using the paired "t" test. The results showed a mean platelet count of 215,979.9 with a standard deviation of 201,934.8 for the manual method, while the automated method had a mean platelet count of 208,080.4 with a standard deviation of 201,226.0. The "t" value for this comparison was 2.58, with a p value of 0.011. This indicates a significant difference ($p<0.05$) in platelet counts between the two methods. (Table 1).

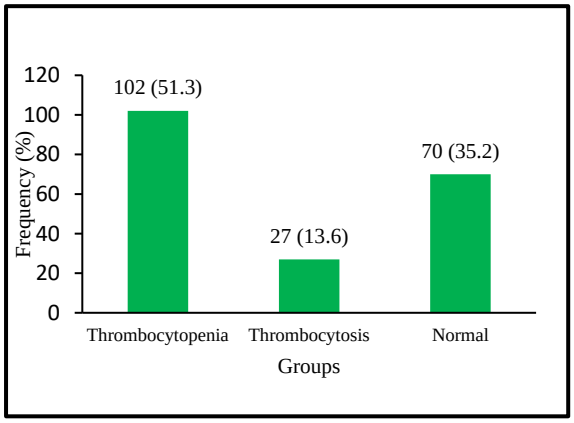


**Figure 3: Patients according to the group.**

The comparison of platelet counts between different groups using the One-way ANOVA. For the manual method, the mean platelet count was 78,921.6 (SD=37,338.9) for the thrombocytopenia group, 660,074.1 (SD=101,819.2) for the thrombocytosis group, and 244,400.0 (SD=72,838.6) for the normal group. The F value was 921.08, with a p value of less than 0.001, showing a significant difference in platelet counts between the groups. For the automated method, the mean platelet count was 69,666.7 (SD=33,848.6) for the thrombocytopenia group, 641,185.2 (SD=130,382.9) for the thrombocytosis group, and 242,714.3 (SD=71,921.3) for the normal group. The F value was 761.05, with a p-value of less than 0.001, also showing a significant difference in platelet counts between the groups. (Table 2)The independent sample "t" test was use to compare platelet counts by gender. For the manual method, males had a mean platelet count of 204,869.2 (SD=201,068.4), and females had a mean of 236,913.0 (SD=203,369.1). The "t" value was -1.07 with a p value of 0.288, showing no significant difference. For the automated method, males had a mean platelet count of 194,369.2 (SD=196,020.4), and females had a mean of 236,913.0 (SD=203,369.1). The "t" value was -1.32 with a p value of 0.188, also showing no significant difference. Therefore, there was no significant difference ($p>0.05$) in platelet counts between males and females for either method (Table 3).

The One-way ANOVA was used to compare platelet counts across different age groups. For the manual method, there was no significant difference in platelet counts between age groups ($p=0.115$). The mean counts were 282,354.2 for NB to 20 years, 245,227.3 for 21 to 40 years, 185,774.4 for 41 to 60 years, and 196,907.9 for 61 to 80 years. For the automated method, there was also no significant difference in platelet counts between age groups ($p=0.127$). The mean counts were 274,708.3 for NB to 20 years, 235,400.0 for 21 to 40 years, 179,085.4 for 41 to 60 years, and 189,026.3 for 61 to 80 years. (Table 4)

**Table 1: Comparison of platelet count between manual method and automated method.**

| | | Mean | S.D. | "t" | P value |
|---|---|---|---|---|---|
| **Platelet count** | Manual method | 215979.9 | 201934.8 | 2.58 | 0.011 |
| | Automated method | 208080.4 | 201226.0 | | |

**Table 2: Comparison of platelet count between groups.**

| Platelet count | Groups | Mean | S.D. | "F" | P value |
|---|---|---|---|---|---|
| **Manual method** | Thrombocytopenia | 78921.6 | 37338.9 | 921.08 | <0.001 |
| | Thrombocytosis | 660074.1 | 101819.2 | | |
| | Normal | 244400.0 | 72838.6 | | |
| **Automated method** | Thrombocytopenia | 69666.7 | 33848.6 | 761.05 | <0.001 |
| | Thrombocytosis | 641185.2 | 130382.9 | | |
| | Normal | 242714.3 | 71921.3 | | |

**Table 3: Comparison of platelet count according to gender.**

| Platelet count | Gender | Mean | S.D. | "t" | P value |
|---|---|---|---|---|---|
| **Manual method** | Male | 204869.2 | 201068.4 | -1.07 | 0.288 |
| | Female | 236913.0 | 203369.1 | | |
| **Automated method** | Male | 194369.2 | 196020.4 | -1.32 | 0.188 |
| | Female | 233913.0 | 209699.3 | | |

**Table 4: Comparison of platelet count according to age groups.**

| Platelet count | Age groups | Mean | S.D. | "F" | P value |
|---|---|---|---|---|---|
| **Manual method** | NB to 20 years | 282354.2 | 241775.6 | 2.00 | 0.115 |
| | 21 to 40 | 245227.3 | 216091.0 | | |
| | 41 to 60 | 185774.4 | 189845.6 | | |
| | 61 to 80 | 196907.9 | 168232.9 | | |
| **Automated method** | NB to 20 years | 274708.3 | 251944.2 | 1.92 | 0.127 |
| | 21 to 40 | 235400.0 | 206821.1 | | |
| | 41 to 60 | 179085.4 | 192215.6 | | |
| | 61 to 80 | 189026.3 | 166407.4 | | |

## DISCUSSION

Assessing platelet count is crucial in both clinical practice and research labs. Bleeding can occur due to numerical deficiency or platelet function defect. Accurate and consistent platelet counts are vital for managing patients effectively.[5]

In the present study the average mean values of platelet in manual method were 215979 and in the automated method was 208080 and it showed statically significant that is p values 0.011.[4,9] The accuracy of platelet counts obtained with a hematology analyzer could be endangered by dealing with blood samples that have low platelet counts or abnormal platelet morphology, like large platelets. Additionally, the accuracy of the data may be impacted by non-platelet particles like red blood cell (RBC) and white blood cell (WBC) fragments can also affect the accuracy of the results. Inadequate quality control materials and calibrations further diminish the hematology analyzer's ability to accurately measure platelet counts.[7,8]

The study was done by Ike et al, found significant differences between manual and automated count result with p value <0.001 and another study was done by Badadoko et al, found there is a difference in mean values of platelet count in manual method and automated method with p value 0.043.[9,10] A similar study was done by Aashna et al., found the differences in the mean values of platelet in manual and automated method with p value <0.001.[11] When comparing platelet counts across different clinical groups, significant differences were observed between manual and automated methods. Specifically, in thrombocytopenia cases, the automated analyzer showed a significantly lower mean platelet count (69,666.7) compared to the manual method (78,921.6), with a p value of <0.001, consistent with findings by Lawrence et al (p=0.038) and Rashid et al (<0.001).[12,13] Similarly, for thrombocytosis and normal platelet counts, significant differences were also found between the automated and manual methods (p<0.001), aligning with observations by Jain et al (<0.0001).[14]

In our study no significant difference in platelet counts between gender and age for both manual and automated methods, as the p values exceed 0.05. This finding suggests that gender and age may not be a substantial factor influencing platelet count variation in the study population. Our study shows that the platelet count from manual method is slightly elevated compare to the count from automated analyzer might not accurately detect and count. Manual platelet counts using thin air-dried films can be sufficiently accurate. However, they tend to be highly variable compared to the more consistent and precise automated platelet counts.[14]

Several researchers have examined the outcomes of both manual and automated platelet counting methods. These results emphasize the significance of acknowledging variations in platelet counts during clinical evaluations and underscore the necessity for standardized measurement techniques.

## CONCLUSION

A present study found variations in platelet counts between manual and automated methods, as well as among different patient groups. However, there was no significant difference in platelet counts based on gender or age groups. These findings highlight the importance of considering platelet count variations in clinical assessments and the need for standardized measurement methods.

Platelet count is a crucial aspect of diagnosing various medical conditions, particularly those related to bleeding disorders or clotting abnormalities. Manual and automated methods are employed for platelet count to ensure accuracy and reliability in results. Manual methods involve visually counting platelets under a microscope, which can be time-consuming and subjective but can offer precision in certain cases. Automated methods utilize specialized equipment to rapidly count platelets, offering efficiency and consistency in results. However, they may miss certain abnormalities that manual methods can catch. By employing both manual and automated methods, healthcare professionals can cross-validate results, ensuring the most accurate diagnosis and treatment for patients. Analysis revealed that the platelet count obtained through the manual method slightly higher than that obtained through the

automated method. This variance may be attributed to the presence of larger-sized platelets that the automated analyzer may not accurately count

Limitation of the present study are to identify specific factor attributing toward manual and automated method of platelet counting and underlying health conditions, Medications used. Future research should aim to overcome these limitations to gain a better understanding of platelet count variations in manual and automated methods. This will facilitate the development of more precise and consistent measurement techniques for clinical assessment.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Tyagi T, Jain K, Gu SX, Qiu M, Gu VW, Melchinger H, et al. A guide to molecular and functional investigations of platelets to bridge basic and clinical sciences. Nat Cardiovasc Res. 2022;1(3):223-37.
2. Meijden PE, Heemskerk JW. Platelet biology and functions: new concepts and clinical perspectives. Nat Rev Cardiol. 2019;16(3):166-79.
3. Giles C. The platelet counts and mean platelet volume. Br J Haematol. 1981;48(1):31-7.
4. Balduini CL, Noris P. Platelet count and aging. Haematologica. 2014;99(6):953.
5. Briggs C, Harrison P, Machin S. Continuing developments with the automated platelet count. Int J Lab Hematol. 2007;29(2):77-91.
6. Singh DJ, Parvaiz S, Shafi A, Jeelani N, Jeelani M. Comparison of platelet count by automated and manual methods, A study and review of literature in a medical college hospital in Kashmir. BJMHS. 2020;2:177-88.
7. Briggs C, Harrison P, Machin SJ. Continuing developments with the automated platelet count. Int J Lab Hematol. 2007;29(2):77-91.
8. Charie LA, Harrison P, Smith CU, Cobb JR, Briggs C, Machin S. Accuracy in the low platelet count range: A comparison of automated platelet counts on Beckman coulter high volume hematology analyzers with the ISLH/ICSH platelet reference method. Lab Hematol. 2001;7:236-44.
9. Ike SO, Nubila T, Ukaejiofo EO, Nubila IN, Shu EN, Ezema I. Comparison of haematological parameters determined by the Sysmex KX - 2IN automated hematology analyzer and the manual counts. BMC Clin Pathol. 2010;10:3.
10. Babadoko AA, Ibrahim IN, Musa AU, Usman N. Reproducibility of haematological parameters: Manual versus automated method. Sub-Saharan Afr J Med. 2016;3(2):65-70.
11. Mahajan D, Aashna, Koul K, Jandial A. Platelet count correlation: automated versus manual on peripheral smear. Indian J Pathol Oncol. 2019; 6(3):381-7.
12. Lawrence JB, Yomtovian RA, Dillman C, Masarik S, Chongkolwatana V, Creger RJ, et al. Reliability of automated platelet counts: comparison with manual method and utility for prediction of clinical bleeding. Am J Hematol. 1995; 48:244-50.
13. Geelani S, Rashid F, Shafi N, Nabi F, Wani I. Assessment of platelet count in normal Kashmiri population. Int J Res Med Sci. 2017;5(12):5319-22.
14. Jain DK. Comparison of platelet count by manual and automated method. Int J Res Med Sci. 2020;8(10):3523.

**Cite this article as:** Gayathri M, Prajna KM, Ullas C. A comparative study of platelet count by manual method and automated analyser: a retrospective study. Int J Res Med Sci 2024;12:3326-30.