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A STUDY ON THE PLATELET COUNT BY MANUAL AND AUTOMATED METHOD IN ANEMIC PATIENTS: A COMPARATIVE APPROACH

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ABSTRACT

Objectives: Platelets, also known as thrombocytes, are tiny cell fragments, shaped like disks of blood which are important for the formation of blood clots and the repair of wounds. Due to its immense importance in medical research, it is equally important to investigate the accuracy of the methods to estimate it. For this purpose, in the present study, an attempt has been made to compare the platelet count by manual and automated method in anaemic patients. **Methodology:** The study was designed as a cross-sectional analysis on stratified randomly selected 120 anaemic patients of Kashmir region. In manual method, platelet counts were determined using a hemocytometer, allowing for visual examination and counting of platelets under a microscope. In automated method, platelet counts were measured using an automated hematology analyzer, providing fast and accurate results. **Results:** The study demonstrated variation in platelet count between automated analyzer and manual platelet counting. In the age-group 18-25 years, the platelets analyzed by Analayzer was 1.5, by Neubauer Chamber was 1.7 and by by PBF was 1.9. In age group 26-35 years, the platelets count analyzed by Analayzer was 1.4, by Neubauer Chamber was 1.6 and by by PBF was 1.5. In age group 36-45 years, the platelets analyzed by Analayzer was 1.3, by Neubauer Chamber was 1.5 and by by PBF was 1.4. **Conclusion:** It may be concluded that both methods can capitalize on their respective strengths, ensuring accurate and reliable platelet counts in clinical practice. It could be also concluded that manual method emerged as the most accurate and could serve to quality-check automated analysers or aid underprivileged laboratories in patient management.

KEYWORDS: Platelet count. Manualmethod. Automated method. Anaemic patients.

INTRODUCTION

Platelets (or thrombocytes) are essential to blood as they are part of hemostasis and circulation. They help maintain vascular integrity through their unique shape which is disk-like with a swollen middle part called granular inclusion. In different physiological processes and pathological conditions, these tiny blood fragments known as platelets exhibit different structures, forms and functions. This elaborate review focuses on platelets and how they are involved in preventing too much blood loss after accidents or during surgeries as well as their importance especially in connection with disorders resulting from them (Anitha et al., 2014).

Platelet function disorders involve abnormalities in the way platelets adhere, activate, or aggregate. These disorders can be inherited or acquired (Balakrishnan A, et al., 2018). While there is extensive literature on the methodologies for platelet counting and their clinical significance, there is a paucity of research specifically comparing manual and automated platelet counting methods in anaemic patients. The unique physiological and pathological conditions associated with anaemia necessitate a targeted study to understand the accuracy and reliability of these methods in this specific patient population. Such research is critical for developing standardized approaches that ensure accurate diagnosis and effective management of anaemia. (Bhasker, 2022). Thus, in the present study an attempt has been made to compare the platelet count by manual and automated method in anaemic patients.

MATERIALS AND METHODS

Study Design

The study was designed as a cross-sectional analysis on stratified randomly selected 120 anaemic patients of Kashmir region. The study was conducted in the Department of Hematology at a major hospital in the Kashmir region. This hospital was chosen due to its comprehensive healthcare services and its capacity to support the necessary laboratory tests and assessments required for the study. This approach allowed the researchers to evaluate both methods at a single point in time, providing a comprehensive snapshot of the current situation regarding platelet count measurement in this patient population. The setting provided a controlled environment where standardized procedures for blood collection, hematological analysis, and data collection were consistently followed.

Blood Sample Collection

Trained laboratory technicians performed venous blood collection from eligible participants using standard phlebotomy techniques. Blood samples were collected in fasting state to standardize sample conditions, and participants were instructed to refrain from iron intake for at least two weeks to one month before the study to avoid interference with platelet count.

Laboratory Tests

Collected blood samples underwent a series of laboratory tests to assess platelet count and related parameters. Tests included both manual and automated methods for platelet counting.

Manual Method: Platelet counts were determined using a hemocytometer, allowing for visual examination and counting of platelets under a microscope.

Automated Method: Platelet counts were measured using an automated hematology analyzer, providing fast and accurate results.

Additional tests included

Complete Blood Count (CBC) to assess hemoglobin, hematocrit, and other blood cell parameters - Serum Iron Test, Total Iron-binding Capacity (TIBC), Transferrin Saturation, and Serum Ferritin Test to evaluate iron status.

Data Collection

In addition to laboratory tests, structured interviews were conducted to gather socio-demographic information, dietary habits, and relevant health history from participants.

Statistical Analysis

Data were analyzed using the SPSS software. Descriptive statistics summarized the demographics and haematological characteristics. Percentage calculation was done for the studied parameters. Chi-square test was applied to estimate the association of the variables studied and the status of anaemia. Statistical significance was set at a p-value of less than 0.05.

RESULTS

Table 1 showed the demographic characteristics of the 120 patients who participated in the study The age distribution revealed that 30% of the participants were between 18-25 years, 50% were between 26-35 years, and 20% were between 36-45 years. Educational levels varied among the participants, with 20% having no formal education, 40% having completed primary education, 30% having secondary education, and 10% having higher education. Socio-economic status was another significant demographic factor, which showed 35% of the participants belonging to a low socio-economic status, 45% to the middle socio-economic status, and 20% to a high socio-economic status.

The prevalence of anaemia among the 120 participants was shown in Table 2 with the distribution of hemoglobin (Hb), serum iron, total iron-binding capacity (TIBC), transferrin saturation, and serum ferritin levels. The maximum 65% of the participants exhibited hemoglobin levels below 11 g/dL, indicative of anemia. Moreover, 60% showed serum iron levels below 50 µg/dL, 55% had TIBC levels exceeding 400 µg/dL, 70% displayed transferrin saturation below 16%, and 75% demonstrated serum ferritin levels below 15 ng/mL.

Table 1: Demographic characteristics of the participants.

Demographic Variable	Frequency (n=120)	Percentage (%)
Age-group		
18-25 years	36	30
26-35 years	60	50
36-45 years	24	20
Education level		
No Formal Education	24	20
Primary Education	48	40
Secondary Education	36	30
Higher Education	12	10
Socio-economic status		
Low	42	35
Middle	54	45
High	24	20

Table 3 presented the distribution of haemoglobin levels among the 120 participants. 15% of the participants exhibited haemoglobin levels below 8.0 g/dL, indicative of severe anaemia, 50% of the participants fell within the haemoglobin range of 8.0-10.9 g/dL, signifying moderate anaemia, approximately 25% demonstrated haemoglobin levels ranging from 11.0-12.9 g/dL, while 10% displayed levels of 13.0 g/dL or higher, suggesting normal haemoglobin levels.

Table 2: Prevalence of anaemia based on haematological parameters.

Haematological parameter	Cut-off value	Frequency (n=120)	Percentage (%)
Hemoglobin (Hb)	<11 g/dL	78	65
Serum Iron	<50 µg/dL	72	60
Total Iron-binding capacity (TIBC)	>400 µg/dL	66	55
Transferrin saturation	<16%	84	70
Serum Ferritin	<15 ng/mL	90	75

Table 3: Distribution of haemoglobin levels.

Haemoglobin level (g/dL)	Frequency (n=120)	Percentage (%)
<8.0	18	15
8.0-10.9	60	50
11.0-12.9	30	25
≥13.0	12	10

The age-wise variation of platelet count in 120 participants using automated platelet count analyzer, Neubauer and PBF were shown in Table 4. The result demonstrated variation in platelet count between automated analyzer and manual platelet counting. In the age-group 18-25 years, the platelets analyzed by Analayzer were 1.5, by Neubauer Chamber was 1.7 and by by PBF was 1.9. In age group 26-35 years, the platelets count analyzed by Analayzer was 1.4, by Neubauer Chamber was 1.6 and by by PBF was 1.5. In age group 36-45 years, the platelets analyzed by Analayzer was 1.3, by Neubauer Chamber was 1.5 and by by PBF was 1.4.

Table 4: Age-wise variation of platelet count using automated platelet count analyzer, Neubauer and PBF.

age	Frequency	Female	Male	Plt. count by Analayzer	Plt. count by Neubauer chamber	Plt .count by PBF
18-25 years	36	18	18	1.5	1.7	1.9
26-35 years	60	48	12	1.4	1.6	1.5
36-45 years	24	4	20	1.3	1.5	1.4
	120	70	50	4.2	4.8	4.8

Table 5: Socio-economic and dietary factors associated with anaemia.

Factor(%)	Anemia (n=100)	No Anemia (n=20)	p-value
Low Socio-Economic Status	70	10	<0.01
Inadequate Dietary Intake	90	20	<0.01
Low Education Level	80	20	<0.05

Table 5 exhibited the socio-economic and dietary factors associated with anaemia. Of those, 70% of participants were from a low socio-economic status, in contrast to only 10% without anaemia, yielding a highly significant association with a p-value of <0.01. Similarly, 90% of participants with inadequate dietary intake exhibited anaemia, whereas only 20% without the condition had insufficient dietary intake, also showing a highly significant association with a p-value of <0.01. Furthermore, 80% of participants with low education levels were found to have anaemia as compared to 20% without the condition, with a significant association indicated by a p-value of <0.05.

DISCUSSION

The demographic characteristics of the patients who participated in the study, showed that the majority of the study population was relatively young, which could influence the generalization of the results to older populations. The findings were supported by the study conducted by Balduini et al. (2014). They stated that platelet count in old age was reduced by 35% in men and by 25% in women with respect to early infancy. Most of the reduction occurred in childhood and in old age, with only minor changes in adulthood. The findings of the present study showed major diversity in the educational status of the participants. This diversity in educational backgrounds may affect the participants' health literacy and their understanding of medical instructions, potentially impacting their adherence to study protocols and treatment regimens. The variation in socio-economic status is crucial as it can influence access to healthcare, nutritional status, and overall health, all of which are important factors in the study of anaemic patients.

The study revealed a high prevalence of anaemia among the 120 participants. This was determined through various haematological parameters such as haemoglobin

(Hb), serum iron, total iron-binding capacity (TIBC), transferrin saturation, and serum ferritin levels. Furthermore, the majority of the participants (50%) had haemoglobin levels within the range of 8.0-10.9 g/dL, indicating moderate anaemia. This prevalence of moderate anaemia underscored the widespread nature of this condition among the studied cohort. An additional 25% of participants had haemoglobin levels between 11.0-12.9 g/dL, while only 10% demonstrated levels of 13.0 g/dL or higher, which suggested normal haemoglobin levels which contradicted to study of Boulassel et al. (2015).

In the present study the higher platelet count was reported using the manual platelet counting as compared to automated analyzer. The findings were with the line of the findings of Geelani, et al. (2017) who reported the variation in platelet count between automated analyzer and manual platelet counting. They also found that platelet count by manual method was higher as compared to the automated method in the laboratory. Higher platelet count by manual method was reported because of large platelet size which analyzers were not able to count.

Manual platelet counting offers several advantages and disadvantages. One of its primary benefits is high accuracy, as the method allows for precise counting when performed correctly by experienced technicians (Balakrishnan et al., (2018**)**. It also enables direct observation, which helps in visually differentiating between platelets and other particles, thereby reducing the chances of false positives (Bhasker, 2022). Furthermore, the manual method provides control over the process, allowing technicians to adjust and ensure meticulous attention to detail during the counting procedure (Anitha et al., 2014). However, manual counting is time-consuming and labor-intensive, requiring significant effort and attention from the technician. The subjective nature of this method can lead to variability in results, depending on the technician's expertise and consistency. Additionally, the manual approach is not suitable for high-volume testing due to its slower process, limiting its throughput in busy clinical settings. Though, Singh and Mane (2024) suggested that the manual method for reticulocyte count iwa as reliable as an automated method, its cost-effectiveness and reliability were useful in small urban laboratories and also in remote rural areas for early diagnosis as well as treatment of anaemia.

On the other hand, automated platelet counting is highly efficient and can handle a large volume of samples quickly, making it ideal for busy laboratories. Automated systems provide consistent results, minimizing the variability associated with human error. These modern analyzers use advanced technology to differentiate platelets from other particles, which enhances accuracy (Maria and Janani, 2019). However, automated counting has its drawbacks. One significant issue is the potential for false positives, as the analyzers can mistakenly count similar-sized particles, such as platelet clumps, white blood cell fragments, giant platelets, and microcytes, as platelets. Additionally, advanced automated systems can be expensive to purchase and maintain, increasing operational costs. Regular calibration and maintenance are necessary to ensure the accuracy of these analyzers, which can be resource-intensive.

CONCLUSION

Both methods can capitalize on their respective strengths, ensuring accurate and reliable platelet counts in clinical practice. It could be also concluded that manual method emerged as the most accurate and could serve to quality-check automated analysers or aid underprivileged laboratories in patient management.

Declaration by Authors

The authors hereby declared that it was their original peace of research and had not been sent to any other journal for publication.

Ethical Approval: Approved.

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