
DIFFERENCES IN HEMOGLOBIN LEVEL EXAMINATION RESULTS USING HB METER AND HEMATOLOGY ANALYZER ON WHOLE BLOOD COMPONENTS OF DONORS IN BLOOD DONATION UNIT PALANG MERAH INDONESIA, GIANYAR REGENCY

Ni Kadek Ayu Cintia Risqi¹, I Gusti Agung Dewi Sarihati², I Gusti Agung Ayu Dharmawati³

^{1,2,3} Jurusan Teknologi Laboratorium Medis

Poltekkes Kemenkes Denpasar

Email: dewisarihati@gmail.com

ABSTRACT

Hemoglobin examination is one of the parameters in quality control of Whole Blood components. Determination of hemoglobin values can be done using the Hb Meter and Hematology Analyzer. This study aims to compare the results of the hemoglobin level examination using the Hb Meter and Hematology Analyzer on Whole Blood components at Blood Donation Unit PMI Gianyar Regency. This type of research is analytic research with a cross sectional approach. Hemoglobin examination was carried out using an Hb Meter and Hematology Analyzer on 16 samples of Whole Blood components. Samples were selected by purposive sampling. The normality of the data was analyzed by the Shapiro Wilk test while the different test used the Mann Whitney test. The average result of hemoglobin levels using the Hb Meter was 15.1 g/dl while the hemoglobin levels using the Hematology Analyzer was obtained an average of 15.3 g/dl. The Mann Whitney test obtained p value = 0.497 so that $p > 0.05$ means that there is no difference in the results of the hemoglobin level examination using the Hb Meter and Hematology Analyzer on the blood component of Whole Blood donors at Blood Donation Unit PMI Gianyar Regency.

Keywords: hemoglobin level; whole blood; Hb meter; hematology analyzer

INTRODUCTION

Blood components managed by the Blood Donor Unit must be subject to quality control. The quality management system accommodates the principles of Good Manufacturing Practice (GMP) or Good Manufacturing Practices (GMP). The main objective of the quality management system for blood supply units is to eliminate risks in blood service activities. These risks include contamination, exchange of blood components, transmission of disease or unwanted side effects due to the use of blood components (Kementerian Kesehatan, 2015).

The blood component that must be monitored for quality is Whole Blood. Based

on the Minister of Health Regulation No. 91 of 2015 Chapter III Sub-Chapter 3.7 concerning specifications and quality control of blood components, it states that the quality of Whole Blood components produced in the Blood Donor Unit must be monitored for quality by conducting several inspections. One of the parameters examined is hemoglobin. The number of blood bags used as samples for the examination is four blood bags per month with a minimum hemoglobin level of 45 g per bag of blood. The percentage of acceptable examination results to pass the test is 75% of the samples meet the criteria (Kementerian Kesehatan, 2015).

Hemoglobin levels can be measured

using an Hb meter and an automatic cell counter (hematology analyzer) which directly measures hemoglobin. There are several measurement methods used in the hematology analyzer, namely electrical impedance, photometry, flowcytometry and histogram (calculation). The hematology analyzer will break down the hemoglobin into a solution and then separate it from other substances using cyanide, then with special irradiation the hemoglobin level is measured based on the value of the light that has been successfully absorbed by the hemoglobin, the measurement results are displayed on the screen (Dameuli, Ariyadi, & Nuroini, 2018).

Examination of hemoglobin levels using an Hb meter is widely used in health services, such as Clinical Laboratories, Public Health Centers, Hospitals and Blood Donor Units. The Hb meter instrument is designed to be portable, meaning that it is easy to carry anywhere and easy to operate.

A previous study conducted by Suryani (2018) with the title "Differences in the Results of Examination of Hemoglobin Levels Using a Stick (Hb Meter) and a Hematology Analyzer" found significant differences. Another related study conducted by Patrick (2016) with the title "Comparison of Hemoglobin Level Examination Results Using the POCT Method with a Hematology Analyzer" concluded that there was no significant difference in mean and there was a correlation with moderate strength.

PMI Blood Donor Units in Regencies/Cities in Bali are still conducting quality control on blood components in a consolidated (centralized) manner, so PMI Blood Donor Units in Kab/Cities in Bali will send samples of blood components to the PMI Blood Donor Unit in Bali Province for quality checks. The blood components that are subject to quality control are only PRC (Packed Red

Cell) and TC (Thrombocyte Concentrate) blood components, while whole blood components are not carried out.

Based on these conditions, the authors are interested in knowing whether there is a difference in the results of the hemoglobin level examination using the Hb Meter and Hematology Analyzer on the blood components of the donors' Whole Blood at the PMI Blood Donor Unit, Gianyar Regency.

RESEARCH METHODS

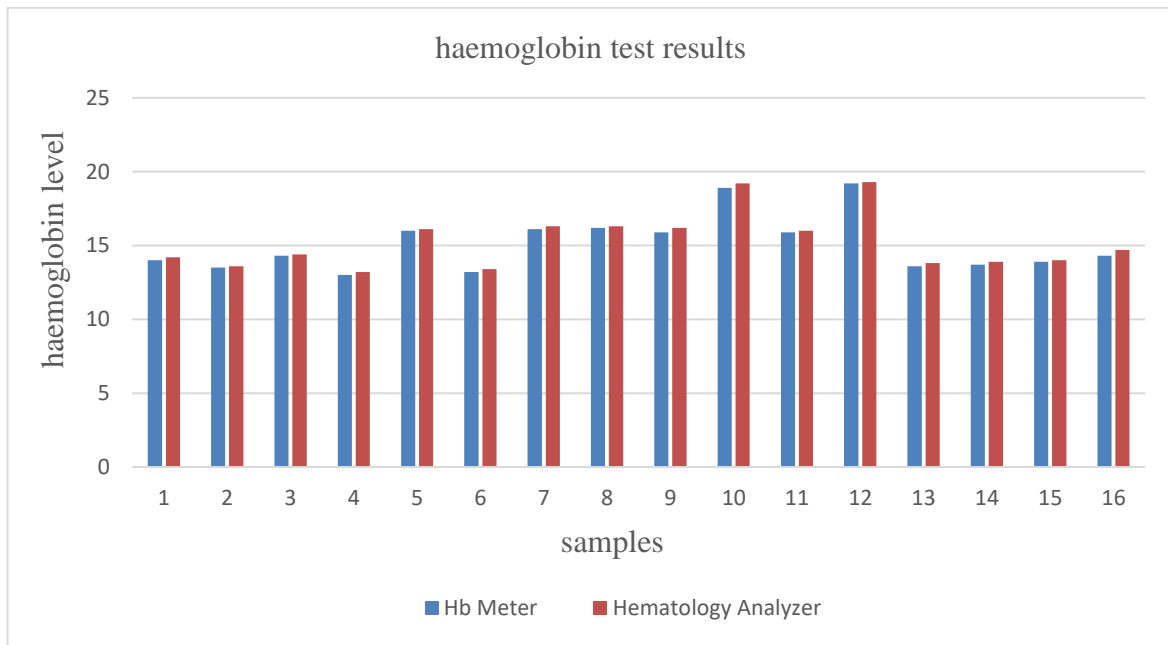
The type of research used in this study is an observational study with a cross sectional design. The research was carried out in March 2021 at the Astina Clinical Laboratory. The research population was Whole Blood blood components available at the PMI Blood Donor Unit, Gianyar Regency. Samples were taken from 16 blood bag hoses, the sampling technique was purposive sampling. The criteria for the research sample are that they have passed the transfusion-transmissible infections (TTI) screening test, passed the confirmation of blood type and the blood sample is in fresh condition, which is less than 24 hours after the collection of donor blood. After sampling, the hemoglobin level was checked using the CompoLab TS Hb Meter and Sysmex XN-350 Hematology Analyzer..

RESULTS AND DISCUSSION

1. Results of hemoglobin level examination

The results of the examination of hemoglobin levels in 16 samples of donor Whole Blood blood components that were examined with the Hb Meter and Hematology Analyzer showed that the results of the examination of the two devices were not much different. The average difference in the results of the two tools is 0.2 g/dl..

Figure 1. Hemoglobin Levels of Whole Blood Donors in the Blood Donor Unit of PMI Gianyar Regen



a. Hemoglobin levels on the Hb Meter

The average result of hemoglobin level examination using the Hb Meter is 15.1 g/dl. The lowest hemoglobin level using the Hb meter was obtained at 13.0 g/dl and the highest result was 19.2 g/dl.

b. Hemoglobin levels on the Hematology Analyzer

The average hemoglobin level examination using the Hematology Analyzer was 15.3 g/dl. The lowest hemoglobin level using the Hematology Analyzer was 13.2 g/dl and the highest was 19.3 g/d.

Analyzer on the blood components of the donor's Whole Blood at the PMI Blood Donor Unit, Gianyar Regency.

b. Differences in hemoglobin levels using the Hb Meter and Hematology Analyzer

Table 1
Differences in Hemoglobin Levels Using the Hb Meter and Hematology Analyzer

No	Examination criteria	average	SD (Standard Deviation)	p
1	Hb level with Hb meter	15,1	1,902	
2	Hb Level with Hematology Analyzer	15,3	1,903	0,497

2. Data analysis

a. Data normality test

The normality test used in this study was the Shapiro Wilk test and the results obtained Sig <0.05, indicating that the data from the examination of hemoglobin levels were not normally distributed. Therefore, the data were analyzed using the Mann Whitney test to find out whether there were differences in the results of the hemoglobin level examination using the Hb Meter and Hematology

Based on the tests that have been carried out, the p value = 0.497 is obtained. This means that p > 0.05 which indicates that there is no difference in the results of the hemoglobin level examination using the Hb meter and Hematology Analyzer on the donor's Whole Blood component at the PMI Blood Donor Unit, Gianyar Regency.

Discussion

Blood donation services as one of the health efforts in the context of healing diseases and restoring health really need the availability of blood or blood components that are sufficient, safe, easily accessible and affordable by the community. Blood and blood products are important in blood transfusion health services (Kementerian Kesehatan Republik Indonesia, 2015). Blood transfusion aims to restore and maintain a normal volume of blood circulation, replace the lack of blood cellular components, increase tissue oxygenation, and improve homeostatic functions in the body (Wahidiyat & Adnani, 2016)(Wahidiyat and Adnani, 2016). The Blood Donor Unit carries out quality control of the blood components produced in order to eliminate risks in blood service activities in the form of contamination, exchange of blood products, disease transmission or unwanted side effects due to the use of blood components (Kementerian Kesehatan Republik Indonesia, 2015). If the quality control of blood components is carried out, then the purpose of the blood transfusion can be achieved

Blood component specifications are a minimum requirement for each blood component and the processing process must be able to produce blood components that meet the requirements. The requirement is in the form of passing the blood component from the predetermined examination. Parameters examined in quality control of Whole Blood blood components are: rhesus ABO blood group examination, TTI screening test (Anti-HIV, Anti-HCV, HBsAg, Syphilis), volume, hemolysis, leukocyte count, bacterial contamination and hemoglobin (Kementerian Kesehatan Republik Indonesia, 2015).

This research was conducted by examining the hemoglobin parameters. Hemoglobin examination was carried out using the Hb Meter and Hematology

Analyzer to see if there were differences in the results of the hemoglobin level examination in the donor's Whole Blood blood component at the PMI Gianyar Regency Blood Donor Unit using these two tools.

1. The hemoglobin level of the donor's Whole Blood component using the Hb Meter

The advantages of the CompoLab TS Hb Meter are that it measures hemoglobin in a short time, the cuvette is not sensitive to humidity and temperature, there are no reagents in the cuvette, the shelf life of the cuvette is 2.5 years, opening the cuvette bag does not affect the expiration date, the cuvette can be filled from an angle. Either way, the cuvette is ventilated to avoid air bubbles in the charged cuvette, always ready for measurement even in standby mode, where the cuvette automatically ejects the cuvette after measurement, uses Li-ion battery (rechargeable battery) which can be used for more than 40 hours if battery fully charged, using USB connection for charging (Kabi, 2012).

The disadvantage of using the CompoLab TS Hb Meter is that the price of the CompoLab TS Hb Meter along with a cuvette is more expensive than the Hb Meter using the POCT method, and although the CompoLab TS Hb Meter is designed to be portable, the size of the tool is larger than the Hb meter with the POCT method so that enough to take up space.

Based on the results of the study, hemoglobin levels using the Hb Meter tool got a lower average result than the Hematology Analyzer tool. Research conducted by Suryani (2018) also reports that hemoglobin examination with the Hb Meter has a lower value than the value on the Hematology Analyzer.

2. Hemoglobin levels in Whole Blood donors using a Hematology Analyzer

Hemoglobin examination uses a Sysmex XN – 350 Hematology Analyzer

Ni Kadek Ayu Cintia Risqi et.all | Differences In Hemoglobin Level Examination Results Using HB Meter And Hematology Analyzer On Whole Blood Components Of Donors In Blood Donation Unit Palang Merah Indonesia, Gianyar Regency

which is a five-part differential hematology analyzer that combines Sysmex technology, namely fluorescence flow cytometry, hydrodynamic focusing and cyanide free SLS. The aspiration volume in Whole Blood mode is 25 l. Hemoglobin parameters using the cyanide free SLS assay method. The cyanide free SLS method uses cyanide-free sodium lauryl sulfate. The principle of the cyanide free SLS method is that the reagent lyses red blood cells and white blood cells in the sample. The chemical reaction begins by converting the globin and then oxidizing the heme group. Furthermore, the hydrophilic SLS group can bind to the heme group and form a stable colored complex (SLS-HGB), which was analyzed using the photometric method. An LED transmits monochromatic light and by moving through the light, the mixture is absorbed by the SLS-HGB complex. The absorbance is measured by a photo sensor and is proportional to the hemoglobin concentration of the sample (Sysmex Europe GmbH, 2018).

The absorption photometric method is usually affected by the turbidity of the sample. In blood samples, cloudiness may be due to lipemia or leukocytosis thereby causing a false increase in hemoglobin levels. By using the SLS-HGB method, this interference can be minimized due to the effect of the reagents used (Sysmex Europe GmbH, 2018).

The advantage of the Sysmex XN-350 Hematology Analyzer is that it has a fully integrated information processing unit with a color touch screen on the device so it doesn't require a separate computer to operate the analyzer and many parameters can be checked. The disadvantages of the Sysmex XN-350 Hematology Analyzer are that the tool is not designed to be portable so that if you want to carry out an examination in the field it cannot be done and the type of sample uses venous blood that is accommodated in a vacutainer tube with anticoagulant so that more samples are taken

than the Hb Meter which can use samples capillary blood.

Based on the results obtained that hemoglobin levels using the Hematology Analyzer tool get a higher average result than the Hb Meter tool. Atmaja's research (2018) also reports that hemoglobin examination with the Hematology Analyzer has a higher value than the value on the Hb Meter.

3. Hemoglobin levels of Whole Blood donors use the Hb Meter and Hematology Analyzer

The Mann Whitney test showed the result that the value of $p = 0.497$, this means that $p > 0.05$, indicating that there is no difference in the results of hemoglobin examination using the Hb Meter and Hematology Analyzer on Whole Blood donors at the Blood Donor Unit PMI Gianyar Regency. The results of this study are in accordance with previous research conducted by Patrick (2016) with the title "Comparison of Hemoglobin Level Examination Results Using the POCT Method with a Hematology Analyzer".

There are several factors that affect hemoglobin examination, namely the turbidity of the sample and the examination reagent. Turbidity in a sample can affect hemoglobin examination by absorption photometric method and cause the hemoglobin level to be higher than it really is. The turbidity can be caused by leukocytosis and lipemia (Dameuli et al., 2018). Reagents are reagents that must always be of good quality from the moment of receipt, all reagents purchased must be considered for the expired license number, the integrity of the container and the way of transportation.

CONCLUSION

There was no difference in the results of the hemoglobin level examination using the Hb Meter and Hematology Analyzer on the blood components of the donor Whole Blood at the PMI Blood Donor Unit, Gianyar Regency.

DAFTAR PUSTAKA

Atmaja. 2018 . *Gambaran Kadar Hemoglobin Dengan Pemeriksaan Menggunakan Metode Point of Care Testing Dan Hematology Analyzer.* Karya Tulis Ilmiah Program Studi Teknologi Laboratirium Medis. Available at: <http://repository.poltekkes-denpasar.ac.id/575/>.

Dameuli, S., Ariyadi, T., & Nuroini, F. (2018). *Perbedaan Kadar Hemoglobin Menggunakan Hb Meter, Spektrofotometer Dan Hematology Analyzer Pada Sampel Segera Diperiksa Dan Ditunda 20 Jam.* Muhamadiyah Semarang. Retrieved from <http://repository.unimus.ac.id/id/eprint/2938>

Kabi, F. 2012. *CompoLab Ts Fast And Accurate Innovative Hemoglobin Screening Technology.* Germany. tp. Available at: <https://www.freseniu>

Kementerian Kesehatan Republik Indonesia. 2015. *Standar Pelayanan Transfusi Darah.* Peraturan Menteri Kesehatan Republik Indonesia No 91 Tahun 2015. Available at [http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No_91_ttg_Standar_Transfusi_Pelayanan_Darah .pdf](http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No_91_ttg_Standar_Transfusi_Pelayanan_Darah.pdf)

Patrick,S.2016. *Perbandingan Hasil Pemeriksaan Kadar Hemoglobin Menggunakan Metode POCT Dengan Alat Hematology Analyzer.* Tesis . FK Universitas Gajah Mada. Available at : <http://etd.repository.ugm.ac.id/penelitian/detail/96081#filepdf>.

Suryani, N. 2018. *Perbedaan Hasil Pemeriksaan Kadar Hemoglobin Dengan Menggunakan Stik (Hb Meter) dan Hematology Analyzer.* Karya Tulis Ilmiah, pp. 1–2.

Available at: <http://repository.unimus.ac.id/1953/>.

Sysmex Europe GmbH. 2018. *XN-350 Products Detail.* Available at: https://www.sysmex.se/index.php?eID=product_pdfgenerator&productUid=3566&languageIso=undefined&productUrl=https://www.sysmex.se/products/product-singleview/xn-350-3566.html&technicalDataUids=46162,46163,46164&productName=XN-350.

Wahidiyat, P. A., & Adnani, N. B. (2016). *Transfusi Rasional pada Anak.* *Sari Pediatri*, 18(4), 325–331. Retrieved from <https://saripediatri.org/index.php/saripediatri/article/view/448/pdf>