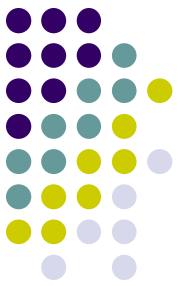




# The evaluation of microtubes' compatibility to automated process for complete blood count

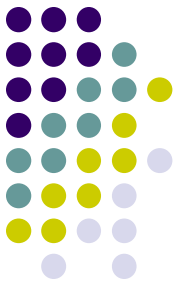
Fatma Demet Arslan<sup>1</sup>, **Ahmet Erkin Bozdemir**<sup>1</sup>, Banu Isbilen-Basok<sup>1</sup>, Sukran Çopur<sup>2</sup>, Nisel Ozkalay Yilmaz<sup>2</sup>

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# Introduction

- Iatrogenic blood loss is known for recurrent sampling in patients with malignancy and pediatric patients especially those in intensive care unit (ICU) inpatients.
- Reducing the amount of blood taken with phlebotomy is crucial avoiding the associated risks.



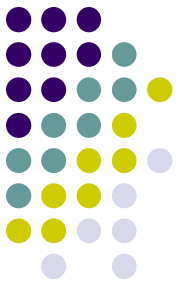
# Introduction

- The introduction of low-volume blood collection tubes (BCT) that are compatible with automated blood counting devices is an important development in many respects.
- Thus, the possibility of reducing the amount of blood taken from the patient has been provided.



# Objectives

- We aimed to evaluate whether low volume BCTs can be safely used in automated systems in laboratories where workload is heavy.
- In this study, we compared each brand BCT with its microtube in terms of accuracy.



# Materials and Methods

- Venous blood samples were taken from 40 inpatients and were collected in three different brand tubes with low and standard volume (six tubes overall).

- **Vacutainer, Microtainer;**  
Becton and Dickinson Company, USA

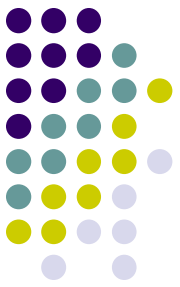


- **S-Monovette, Microvette;** Sarstedt Ag & Co. KG, Germany



- **Vacuette, MiniCollect;**  
Greiner Bio-One GmbH, Austria



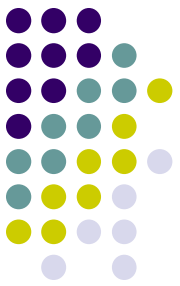


# Materials and Methods

- This study was designed according to European Federation of Clinical Chemistry and Laboratory Medicine (EFLM)\*.
- Samples were taken from patients in accordance with The Clinical & Laboratory Standards Institute (CLSI) GP41-A6\*\* standard by injector because low volume BCTs were vacuum-free.
- Samples were discharged from the syringe into the tubes in a random order.

\* Lippi G, Grankvist K, Nybo M, Simundic AM; Working Group for Preanalytical Phase (WG-PRE); EFLM. Opinion paper: local validation of blood collection tubes in clinical laboratories. Clin Chem Lab Med. 2016;54:755-60

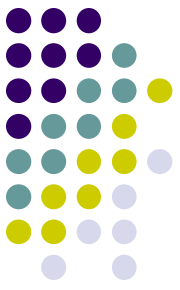
\*\* CLSI, Procedures for the Collection of Diagnostic Blood Specimens by Venipuncture; Approved Standard—Sixth Edition, 2007



# Materials and Methods

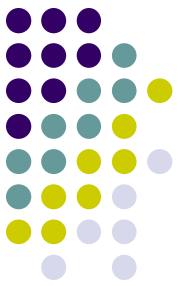
- In the CLSI H01-A5\* standard, the EDTA / blood ratio is recommended as 1.5 mg per 1 mL blood.
- Blood sampling was taken with an injector due to the lack of vacuum in low volume BCTs and the EDTA / blood ratio was difficult to achieve at the same rate for each tube.
- Thus, low and standard volume BCTs of the same brand were compared.





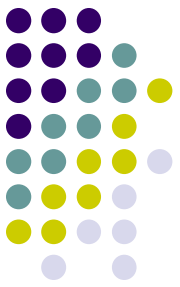
# Materials and Methods

- All tubes contained  $K_2EDTA$  except Microvette (Sarstedt).
- White blood cell (WBC), red blood cell (RBC), hemoglobin, platelet (PLT) were analyzed using a CBC analyzer (DxH 800, Beckman Coulter Inc., USA).
- The samples were run in a random order in duplicate.
- Mean values of the results were compared.



# Materials and Methods

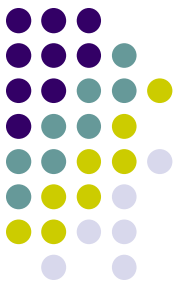
- The analyte levels among the tubes were compared statistically and clinically.
  - To evaluate statistically,
    - The normal distribution of the data was analyzed by Shapiro-Wilk test.
    - The statistical difference between the results according to the normal distribution was evaluated by Wilcoxon or paired T test.
    - The relationship between the results was evaluated by Pearson or Spearman correlation test and Passing-Bablok regression analysis according to the distribution of data.
    - $p$  value  $< 0.05$  was considered statistically significant.



# Materials and Methods

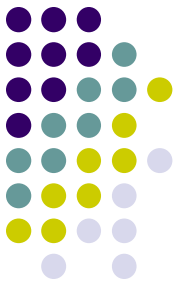
- The analyte levels among the tubes were compared statistically and clinically.
  - To evaluate clinically,
    - The bias (%) of WBC, RBC, hemoglobin, and PLT parameters between a pair of microtube and a standard tube was calculated.
    - All bias calculations were evaluated according to the desirable limits based on the Ricos' biological variation data\*

\* Application of biological variation—a review Carmen Ricós, Carmen Perich, Joana Minchinela, Virtudes Álvarez, Margarita Simón, Carmen Biosca, Mariví Doménech, Pilar Fernández, Carlos-Víctor Jiménez, José Vicente Garcia-Lario, Fernando Cava; *Biochimica Medica* 2009;19(3):250–9



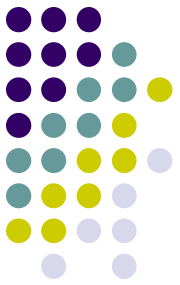
# Results

- Although, there was a statistically significant difference in some parameters, the bias values obtained in clinical evaluation were within acceptable limits.
- No systematic or random error between the results of low and standard volume BCTs were detected. In fact, there was also found to be a strong agreement between each pair.



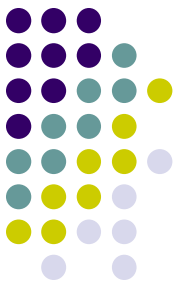
	Sarstedt				Greiner Bio-One				BD				Desirable Bias %
	S-Monovette (Mean±SD)	Microvette (Mean±SD)	Bias (%)	p Value	Vacvette (Mean±SD)	MiniCollect (Mean±SD)	Bias (%)	p Value	Vacutainer (Mean±SD)	Microtainer (Mean±SD)	Bias (%)	p Value	
WBC (10 <sup>3</sup> /μL)	8.60±3.63	8.50±3.59	-1.09	<0.001*	8.43±3.54	8.42±3.59	-0.24	0.203	8.46±3.61	8.42±3.59	-0.41	0.210	6.05
RBC (10 <sup>3</sup> /μL)	3.96±0.87	3.98±0.88	0.61	0.030	3.95±0.87	3.96±0.88	0.34	0.095	3.95±0.87	3.97±0.88	0.52	0.005*	1.70
Hb (g/dL)	11.0±2.3	11.1±2.3	0.51	0.062	11.0±2.3	11.0±2.3	0.05	0.165	11.0±2.3	11.1±2.3	0.46	0.005*	1.84
PLT (10 <sup>3</sup> /μL)	253.4±134.1	250.0±135.1	-1.49	0.013*	252.6±130.8	252.1±135.5	-0.89	0.472	252.6±132.0	249.5±131.0	-1.34	0.003*	5.90

**Table 1.** The clinical and statistical evaluations of CBC parameters in different brand tubes



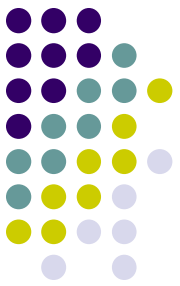
	Sarstedt				Greiner Bio-One				BD				Desirable Bias %
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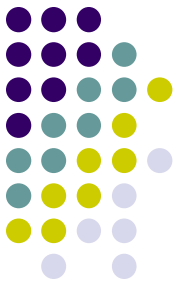


	<b>Sarstedt (Bias %)</b>	<b>Greiner Bio-One (Bias %)</b>	<b>BD (Bias %)</b>	<b>Desirable Bias %</b>
<b>WBC (<math>10^3/\mu\text{L}</math>)</b>	-1.09	-0.24	-0.41	6.05
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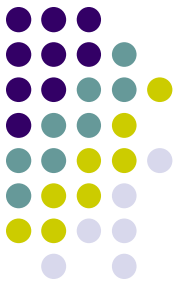
**Table 2.** Summary of bias values between standart and low volume tubes



# Results

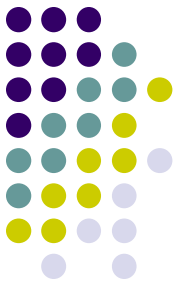


- We have noticed that the bias is in the same direction in the same brand tubes in all parameters.



# Conclusion

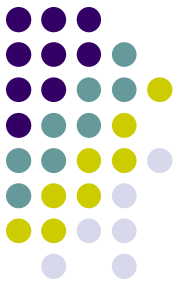
- When the blood count parameters in the pairs of low and standard volume were compared, the adaptation of the existing low volume BCTs to the automated systems would be advantageous for both the patient and the laboratorian.



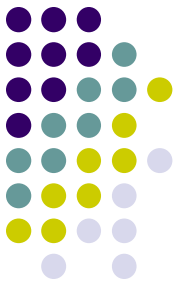
# Conclusion

- These advantages are;
- to reduce the amount of blood drawn from patients (especially in the oncology and pediatric units)
- to prevent iatrogenic anemia
- to shorten the medical waste amount
- to reduce the error of identifications compared not to low volume BCTs adapted to the automated systems
- to lighten manuel work load

# Conclusion



- As far as we observed only limitation for transferring to low volume BCTs that they are vacuum free and do not allow to be repeated for the third times due to the lack of blood sample.



# Keynotes

- We strongly recommend the use of these tubes, especially in patients with difficult blood collection, such as vacuum blood collection systems.
- In other words, we strongly recommend the use of these tubes, in patients collecting blood with the needle tip.

