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ACCURACY AND PRECISION OF URIC ACID EXAMINATION POINT OF CARE TESTING METHOD AND URICASE ENZYMATIC COLORIMETRIC METHOD

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ABSTRACT

The method that often used in clinical chemistry examinations in laboratory such as analysis of blood glucose, uric acid, cholesterol, triglycerides, bilirubin, and albumin are POCT method and the uricase enzymatic colorimetric method. The POCT method is a automatic method that quickly obtains result. While the uricase enzymatic colorimetric method is a manual method that still requires special treatments to obtain result. In this study, the parameters of uric acid examination were chosen because uric acid is a rheumatic disease that ranks third after arthrosis and rheumatoid arthritis. It was estimated that almost 80% of the population aged 40 years or older have gout sufferers in Indonesia. Therefore, a study was conducted on the accuracy and precision of the POCT method and the uricase enzymatic colorimetric method, which aims to determine the accuracy and precision of uric acid examination POCT method and uricase enzymatic colorimetric method. The data analysis used is descriptive analysis to analyze the value of accuracy and precision. As the results of this research, 12.30% of bias value and 110.88% of recovery value were generated. While the coefficient of variation from the POCT method were 3.5% and the uricase enzymatic colorimetric method were 5.37%. Based on these results, it could be concluded that the accuracy and precision of uric acid examination using the POCT method and the uricase enzymatic colorimetric method were equally good and both method provided trusted results.

Keywords: Accuracy, Precision, uric acid, POCT, Uricase Enzymatic Colorimetry.

INTRODUCTION

Quality assurance of laboratory examinations is very important to do to establish a diagnosis of a disease so as to obtain the right results. There are two main things that are important to consider in the quality assurance of laboratory examination results, namely accuracy and precision [(1)]. Accuracy is that which shows the accuracy of the measurement results with the actual value, while precision is the accuracy of repeating the analysis by providing the same data [(2)].

Accuracy and precision are included in the verification or validation of methods. The results of the data from a method carried out can be in the form of good precision but not necessarily a guarantee that the data can be said to be accurate. Vice versa, if a method that produces data with high precision or accuracy is not necessarily good precision. In addition, it can also produce accuracy and precision that are both good or poor [(3)].

From the possible results of the data that are not good, it can be reviewed because of an error in the implementation of the pre-analytic stage, the analytical stage or the post-analytic stage. If this error occurs, it will be very detrimental to the patient. Currently, a tool that allows it to be used as examination with the advantage of getting fast results is the POCT (Point-of-care testing) method. The method can be defined as a diagnostic test tool that is carried out near the patient or examination facility with a short processing time and the results are immediately available [(4)].

Therefore, many people have a very high level of trust in the use of automated tools, but do not know that this sophisticated examination method does not guarantee the accuracy of the diagnosis [(5)]. In addition, it can be seen that for several examinations the POCT method and the uricase enzymatic colorimetric method can be carried out, among others, namely blood glucose examination, hemoglobin examination, total cholesterol examination or uric acid examination. In this study, the parameters of uric acid examination will be chosen because uric acid is a rheumatic disease that ranks third after arthrosis and rheumatoid arthritis. It can be estimated that almost 80% of the population aged 40 years or over have gout sufferers in Indonesia [9].

Based on the above statement, it can be seen that the need for quality control on the accuracy and precision of a tool with the POCT method to find out the results of the examination issued or submitted to a person are truly

valid according to their sick or normal health condition and to make a solution to the demands for the results of the examination. fast. Thus, a tool with an automated method not only provides fast results but also provides accurate results. Therefore, a study was conducted on the accuracy and precision of uric acid examination using the POCT method and the uricase enzymatic colorimetric method.

METHODS

The used research type was descriptive analytic method. It was to analyze the percentage value of accuracy and precision of uric acid examination in the POCT method and the uricase enzymatic colorimetric method as well as a cross sectional approach. Cross sectional was a type of research in which the measurement of the variables was carried out at one time. Respondents that was used as many as 10 people obtained by random sampling technique and repeated examination of uric acid in each person 3 times. The research was carried out from November 2020 to May 2021 at the Kadur Health Center, Kadur District, Pamekasan Regency. The method of data collection in this study was used primary data obtained from the respondents' consent to obtain the results of the examination of uric acid levels using the POCT method and the uricase enzymatic colorimetric method. This research has been ethical exemption with the certificate number was NO.EA/473/KEPK-Poltekkes_Sby/V/2021.

This study begins with taking capillary blood samples and venous blood for examination of uric acid levels. The first capillary blood obtained by piercing the middle or ring finger using a lancet then capillary blood appears. The blood is then dripped on the instrument and then the results are automatically read by waiting a few seconds so that the results can be obtained immediately while the venous blood is obtained in the folds of the arm using a syringe. The blood that has been obtained is processed on a uricase enzymatic colorimetric method. Prior to that, the blood obtained was first centrifuged so that the blood components were separated to obtain serum, then 20 µL of serum was pipetted as much as 1000 µL of uric acid reagent and incubated for 10 minutes at 25°C. After that, the readings were carried out on the uricase enzymatic colorimetric method. The results of the exits are then recorded. Data from the results of the examination of uric acid levels will be analyzed using descriptive methods presented in tabular form and interpreted in percentages.

RESULTS

Table 1 and table 2 below were the results of uric acid examination using the POCT method and the uricase enzymatic colorimetric method which were repeated 3 times for each examination carried out on the community in Kadur District, Pamekasan Regency. The normal value for uric acid examination for man was 3.4 – 7.2 mg/dL, while for women was 2.6 – 6.6 mg/dL.

Table 1. Results of uric acid examination used the POCT method

Number	Code names	Uric acid test results (mg/dL)		
		1	2	3
1.	MK	6,5	6,2	6,4
2.	MS	11,2	11,8	11,5
3.	UF	3,7	3,9	4,0
4.	SM	5,3	5,3	5,6
5.	FM	3,6	3,7	3,7
6.	OC	4,7	4,8	4,4
7.	NS	4,4	4,7	4,6
8.	MR	4,4	4,1	4,1
9.	NH	5,3	5,0	5,9
10	EH	7,2	6,9	7,0

Repeated POCT method of uric acid examination gave results that were not much different. The maximum was not more than 1.0 mg/dL. All of the respondents had normal uric acid values and some were up to normal. Based on table 1, only one person have a up normal value while the others are within normal values.

Table 2. Results of uric acid examination used the enzymatic colorimetric method

Number	Code names	Uric acid test results (mg/dL)		
		1	2	3
1.	MK	4,9	4,9	5,0
2.	MS	9,9	9,9	9,8
3.	UF	4,0	4,7	5,0
4.	SM	4,9	5,2	5,1
5.	FM	3,0	3,5	3,2
6	OC	3,9	4,4	4,5
7.	NS	3,9	4,6	4,4
8.	MR	2,9	2,8	2,6
9.	NH	4,5	5,7	5,4
10	EH	6,6	7,1	6,9

Based on table 2 when using the uricase enzymatic colorimetric method, the repetition results obtained were both not much different from the POCT method. The maximum distance obtained was 1.2 mg/dL. As well as only one only one person have a up normal value while the others were within normal values for uric acid examination. It was same as the poct method.

Table 3 below was a table for calculating the accuracy value. Accuracy was presented in the form of inaccuracy which was expressed in terms of bias (%) and recovery (%). The calculation required is average results of the POCT method were considered as the calculation of examination value and the average results of the uricase enzymatic colorimetric examination are considered the correct values.

Table 3. Accuracy of uric acid examination for POCT method against uricase enzymatic colorimetric method

Number	POCT method average (mg/dL)	*Uricase* enzymatic colorimetric method average (mg/dL)	Bias value (d%)	*Recovery* value (R%)
1.	6,37	4,93	29,21	129,21
2.	11,50	9,87	16,51	116,51
3.	3,87	4,57	15,32	84,68
4.	5,40	5,07	6,51	106,51
5.	3,67	3,23	13,62	113,62
6.	4,63	4,27	8,43	108,43
7.	4,57	4,30	6,28	106,28
8.	4,20	2,77	51,62	151,62
9.	5,40	5,20	3,85	103,85
10	7,03	6,87	2,33	102,33
Average	5,66	5,11	12,30	110,88

According to table 3 that the accuracy of the POCT method of uric acid examination against the uricase enzymatic colorimetric method, the average result of the POCT method of uric acid examination was 5.66 mg/dl, the average result of the colorimetric uricase enzymatic examination was 5.11 mg/dl. dL. While the bias value obtained was 12.30% and the Recovery value was 110.88%.

Table 4 was calculation of the precision POCT method. Precision was expressed in terms of impressions which were expressed in terms of the coefficient variation. The calculation required was average results POCT method of uric acid examination and the standard deviation and then multiplied by one hundred. The precision value was expressed in percentage units.

Table 4. Precision for examination of uric acid used the POCT method

Number	POCT method average (mg/dL)	Standart deviation	Coefficient variation (%)
1.	6,37	0,15	2,40
2.	11,50	0,30	2,61
3.	3,87	0,15	3,95
4.	5,40	0,17	3,21
5.	3,67	0,06	1,57
6.	4,63	0,21	4,49
7.	4,57	0,15	3,34
8.	4,20	0,17	4,12
9.	5,40	0,46	8,49
10	7,03	0,15	2,17
Average	5,66	0,20	3,50

According to Table 4, it was known that the examination of uric acid in the POCT method which was carried out in the laboratory of the Kadur Health Center, Pamekasan Regency, the average result of uric acid was 5.66 mg/dl and the standard deviation was 0.20. While the coefficient of variation of uric acid was 3,50 %.

Table 5 below was calculation of the precision uricase enzymatic colorimetric method. The calculation needed was average results uricase enzymatic colorimetric method of the uric acid examination and the standard deviation then multiply by one hundred to be expressed in percentage units.

Table 5. Precision for uric acid examination used uricase enzymatic colorimetric Method

Number	*Uricase* enzymatic colorimetric method average (mg/dL)	Standart deviation	Coefficient variation (%)
1.	4,93	0,06	1,17 %
2.	9,87	0,06	0,59 %
3.	4,57	0,51	11,24 %
4.	5,07	0,15	3,01 %
5.	3,23	0,25	7,78 %
6.	4,27	0,32	7,53 %
7.	4,30	0,36	8,39 %
8.	2,77	0,15	5,52 %
9.	5,20	0,62	12,01 %
10	6,87	0,25	3,66 %
Average	5,11	0,27	5,37 %

According to Table 5, it was known that the examination of uric acid in the uricase enzymatic colorimetric method was carried out in the laboratory of the Kadur Health Center, Pamekasan Regency with average uric acid result was 5.11 mg/dl and a standard deviation was 0.27. While the coefficient variation of uric acid obtained results was 5.37%.

DISCUSSION

Based on table 1 and table 2, the results of research that have been carried out on 10 respondents, the average results of the POCT method of uric acid examination was 5.66 mg/dL and the average results of uric acid examinations using the Uricase enzymatic colorimetric method was 5.11 mg /dL. Then proceed to determine the accuracy and precision of the two methods. In table 3, the refractive values and recovery values for the POCT method of uric acid examination against the uricase enzymatic colorimetric method were 12.30% and 110.88%.

The bias value can be positive or negative. If the bias value was 12.30%, it was showed that the measurement results obtained was higher than the results of the control material. Meanwhile, if the negative value indicates the measurement results obtained was lower the results of the control material. The recovery value obtained includes a good criterion value, which is between 85% - 115%. So it can saw that the accuracy of uric

acid examination in the POCT method against the uricase enzymatic colorimetric method is high. This high accuracy indicates that the accuracy of the examination values obtained from the POCT method against the examination values of the uricase enzymatic colorimetric method was good.

In table 4, the coefficient of variation was 3.50%, while in table 5, the coefficient of variation was 5.37%. The value of the coefficient of variation was used to determine precision. The maximum limit value that has been determined on the coefficient of variation for uric acid examination is 6%. The smaller the value of the coefficient of variation, the higher the accuracy or said to be very good [7]. Therefore, it can be seen that the coefficient of variation in the POCT method of uric acid examination is below the maximum limit which indicates that the POCT method has good precision.

According to previous research conducted by (karyaty & Rosdarni, 2018) about the analysis of internal quality stabilization of blood glucose examinations at the regional health laboratory in the Southeast Sulawesi province, the results of the level of accuracy (d%) in the preliminary period were 1.56% and the control period was 1.62% which showed accuracy. which was good, while the level of accuracy (KV%) in the preliminary period was 4.05% and the control period is 4.63% shows good accuracy. In addition, in research (Ketrina et al, 2017) on the description of internal quality stabilization of blood glucose examinations at the Laboratory of RSU GMIM Pancaran Kasih Manado, the results of the test of accuracy and precision were d% value of 0.05% and the coefficient of variation value was 1.81 %. This value indicates good accuracy and precision. Based on the results of these previous studied that research on the accuracy and precision of uric acid examination point of care testing method and the uricase enzymatic colorimetric method were accordance with previous research.

CONCLUSION

Based on these results, it could be concluded that the accuracy of uric acid examination using the POCT method against the uricase enzymatic colorimetric method was good with a bias value of 12.30% and a recovery value of 110.88%. As well as the precision of uric acid examination using the POCT method and the uricase enzymatic colorimetric method was good with the coefficients variation were 3.50% and 5.37%, respectively.

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