DIFFERENCES IN BLOOD GLUCOSE LEVELS BY USING EDTA'S SERUM AND PLASMA WAS EXAMINED IMMEDIATELY AND POSTPONED 2 HOURS AT EFARINA BERASTAGI HOSPITAL

Sri Wahyuni Tarigan 1, Richard Frimpong Oppong[2], Josep Lubis[3], Romauli Pakpahan[4], Doortua[5]
(Institution/University, Academic Activities, etc.) [1,3,4,5]
(Thompson Rivers University-Canada)[2]

*Correspondence: sriwahyunitarigan21@gmail.com

Abstract
Blood glucose examination in the laboratory is used to determine blood glucose levels in the body. Delay in examination time can cause a decrease in blood glucose levels, so the results obtained do not match the actual body condition. This study aims to determine the difference between blood glucose levels in EDTA plasma samples and serum which were examined immediately and delayed for two hours. This research was conducted using an experimental observation method, namely clinical laboratory observations by measuring blood glucose levels using blood chemistry. The results of examining serum and plasma glucose levels in this study showed that the average value of glucose levels with plasma EDTA which was checked immediately was 99 mg/dl delayed 67.9 mg/dl and serum which was checked immediately was 100.8 mg/dl delayed 100.4 mg /dl.

Keywords:EDTA, Serum, Plasma Blood Glucose, Delayed For 2 Hours.

INTRODUCTION

Health laboratory or clinical services are services that can support the diagnosis of disease or monitor the recovery of patients. One of the parameters of service quality in the laboratory is overcoming several error factors. In the laboratory, errors in service can be categorized into three, namely errors in the preanalytical process (mistakes in identification of samples, errors in requests, errors in phlebotomy technique, selection of tools and materials), (Kitchen, Olso & Preston, 2009).

Clinical laboratory examination is one of the important supporting factors in helping to diagnose a disease, one of which is blood glucose examination (Joyce, 2013). Examination of blood glucose levels is an examination with the aim of determining the presence or absence of diabetes mellitus. Diabetes mellitus is a group of chronic diseases characterized by increased blood glucose levels as a result of disturbances in the body's metabolic system, where the pancreas is no longer able to produce the insulin hormone according to the body's needs (Pradana, 2014). The specimen used for blood glucose examination is serum or plasma EDTA. Serum is a clear yellow liquid which is obtained from a certain amount of blood and then put into a tube (Pearce, 2015).

The blood is allowed to clot first at room temperature for 20-30 minutes, then centrifuged at 3000 rpm for 5-15 minutes (Ministry of Health RI, 2011). The anticoagulant EDTA in the blood binds to calcium ions thereby inhibiting coagulation. EDTA cannot inhibit glycolysis, causing blood glucose levels to decrease (Kurnianingsih, 2011). Blood glucose examination is an initial screening procedure for Diabetes Mellitus which shows the inability of pancreatic cells to produce insulin, the inability of the small intestine to

Sri Wahyuni Tarigan[1], Richard Frimpong Oppong[2], Josep Lubis[3], Romauli Pakpahan[4], Doortua[5]

absorb glucose, the inability of cells to use glucose efficiently, or the inability of the liver to collect and break down glycogen (Ministry of Health, 2011). It has long been known that the metabolism of glucose in serum in blood-filled tubes decreases over time. When the blood specimen has not been tested,

Based on research experience at the Rs Efarina Berastagi laboratory, chemical examinations, especially blood glucose examinations, are rarely carried out frequently using manual tools which are directly examined and results come out faster than using chemical devices if many patients are checked using chemicals, for example checking albumin and others, glucose is also used. chemicals were also checked.

Delaying the time of checking blood glucose can cause a decrease in blood glucose levels, this is due to the process of blood cells. The process of glycolysis that occurs in cells begins with the formation of glucose molecules and ends with the formation of glucose molecules and ends with the formation of pyruvic acid, where the formation of acids in the glycolysis process requires 2 ATP molecules which are used to transfer phosphate groups to glucose so that glucose has a higher energy store. , the energy is used for the next reaction, namely the energy release reaction. High blood cell counts can cause excessive glycolysis resulting in frequent blood glucose checks using EDTA plasma. The fibrinogen content contained in the plasma by the addition of anticoagulants can prevent blood clots from occurring. The use of plasma samples is used as an alternative to serum when the serum obtained is very small in an emergency (Guder, 2009).

One of the purposes of this blood glucose examination is to determine the presence or absence of diabetes mellitus. Diabetes mellitus is the most prominent disease caused by failure to regulate blood sugar or abnormalities in carbohydrate metabolism. In this case blood glucose cannot be used properly, resulting in a state of hyperglycemia. This reflects that glucose activity still occurs even though it is outside the body. From experience and surveys obtained from the field, chemical examinations, especially blood glucose examinations, have never used EDTA plasma samples.

Research purposes

1) Measuring blood glucose levels using serum
2) Measuring blood glucose levels using plasma EDTA
3) Measures blood glucose levels directly
4) Measure blood glucose levels on hold for 2 hours.
5) Knowing the difference in blood glucose levels by using serum and plasma EDTA directly and delayed for 2 hours.

LITERATURE REVIEWS

Glucose

Glucose, a monosaccharide sugar, is one of the most important carbohydrates used as the main source of energy in the body. Glucose is the precursor for the synthesis of all other carbohydrates in the body such as glycogen, ribose and deoxiribose in nucleic acids, galactose array et al., 2003).

Sri Wahyuni Tarigan[1], Richard Frimpong Oppong[2], Josep Lubis[3], Romauli Pakpahan[4], Doortua[5]

Formation of alternative energy can also come from the metabolism of fatty acids. But this pathway is less efficient than in milk lactose, in glycolipids, and in glycoproteins and proteins up to 200 mg/dl in moderate circumstances (Sacher, 2004). If glucose is totally oxidized it will produce carbon dioxide, water, and energy which will be stored in the liver or muscles in the form of glycogen. The liver can convert unused glucose through other metabolic pathways into fatty acids which are stored as triglycerides or into amino acids to form proteins. The liver plays a role in determining whether glucose is directly used to produce energy, stored or used for structural purposes (Sacher, 2004).

Blood

Blood is a liquid that is very important for humans because it functions as a means of transportation and has many other uses to support life. Without enough blood a person can experience health problems and can even result in death. Blood in the human body contains 55% blood plasma (liquid blood) and 45% blood cells (solid blood). The amount of blood in our bodies is about a thirteenth of an adult's body weight or about 4 or 5 liters (djojodibroto 2003). Blood and urine can be used to check blood glucose and can also be checked using serum, plasma and complete blood (Suyono, 2009).

Blood is red, between bright red when it is rich in oxygen to dark red when it is deficient in oxygen. The red color of blood is caused by hemoglobin, a respiratory protein that contains iron in the form of heme, which is where oxygen molecules bind. Humans have a closed circulatory system, which means blood flows in the blood vessels and is circulated by the heart. Blood is pumped by the heart to the lungs to release metabolic waste in the form of carbon dioxide and absorb oxygen through the pulmonary arteries, then brought back to the heart via the pulmonary veins. After that the blood is delivered throughout the body by the aortic blood vessels. Blood circulates oxygen throughout the body through fine blood vessels called capillaries. Blood then returns to the heart via the superior vena cava and inferior vena cava. Blood also transports metabolic waste materials, drugs and foreign chemicals to the liver to be broken down and to the kidneys to be excreted as urine. (Evelyn C. Pearce, 2006).

METHODS

This scientific writing uses a quantitative descriptive method. Quantitative descriptive method is a research method that is carried out with the main objective of creating an objective picture or description of a situation and discussing existing data using parameters and hypotheses as benchmarks (Notoatmodjo, 1993) of blood in sera samples that have been separated and have not been separated from red blood cells with a time delay of 2 hours.

The population in this study were patients who had their blood glucose checked while at Efarina Berastagi Hospital in August 2018 as many as 16 patients who had their blood glucose checked while they were.

RESULTS AND DISCUSSION

Contents Results and Discussion

Patient Characteristics

This research was conducted at Efarina Berastagi Hospital. The sample in this study were patients who had their blood glucose checked in the clinical pathology laboratory at Efarina Berastagi Hospital with a total of 16 patients. The results of the study of differences in blood glucose levels using EDTA plasma and serum samples which were examined immediately and which were delayed for two hours with a total sample of 16 people.

Table of Patient Frequency Based on Characteristics at Efarina Berastagi Hospital

Characteristics	N	%
Gender		
Woman	12 people	75
Man	4 people	25
Total	16 people	

The table above describes the frequency of patients based on gender characteristics as much as 75% female and 25% male. This shows that more patients who check blood glucose levels in the Efarina Berastagi Hospital laboratory are female compared to male patients.

Table of Frequency Based on Age at Efarina Berastagi Hospital

Age	N	%
5 years	1	6,25
20 years	2	12.5
35 years old	2	12.5
56 years	2	12.5
57 years	5	31.25
67 years	3	18.75
75 years	1	6,25

In the table above based on the frequency of patients aged 5 years there is 1 person with a total percentage of 6.25% and patients aged 20 years there are 2 people with a total percentage of 12.5% and patients aged 35 years there are 2 people with a total percentage 12.5% and patients who are aged 56 years there are 2 patients with a total percentage of 12.5% and patients who are 57 years old there are 5 people with a total percentage of

31.25% and patients who are 67 years old there are 3 people with a total percentage of 18 .75% and there is 1 person aged 75 years with a total percentage of 6.25%. We can see that patients aged 50 to 70 years do more glucose level checks. This is because the elderly have a tendency not to move much in activities so that the body does not spend a lot of carbohydrates or glucose for these physical activities. This can trigger the arrival of metabolic diseases such as hypertension, high cholesterol or even diabetes.

Serum Examination

Principle: separating serum from red blood cells to get serum free from red blood cells. The results of the serum examination are shown immediately and delayed for 2 hours.

Table Serum Examination immediately and delayed for 2 hours

No	Patient's name	Total blood volume	Immediate serum examination	Serum examination Delayed 2 hours	Decreased amount of serum
1.	spiritual	3 cc	100.8 mg/dl	100.4 mg/dl	0.4mg/dl
2.	account	3 cc	100.5 mg/dl	82mg/dl	18.5mg/dl
3.	Ropo	3 cc	99.7 mg/dl	73.6 mg/dl	26.1mg/dl
4.	Amelia	3 cc	90.6 mg/dl	75.4 mg/dl	15.2mg/dl
5.	Pintamin	3 cc	129.0 mg/dl	122.2 mg/dl	6.8 mg/dl
6.	Get up	3 cc	302mg/dl	280 mg/dl	22mg/dl
7.	Erpika	3 cc	142 mg/dl	140.1mg/dl	1.9mg/dl
8.	Lau simo	3 cc	114 mg/dl	112 mg/dl	2mg/dl
9.	Siti	3 cc	497 mg/dl	365 mg/dl	132mg/dl
10.	Arsiyati	3 cc	99mg/dl	87 mg/dl	12mg/dl
11.	Kartini	3 cc	112 mg/dl	110 mg/dl	2mg/dl
12.	Ayet	3 cc	131 mg/dl	100 mg/dl	31mg/dl
13.	Mariana	3 cc	217mg/dl	201mg/dl	16mg/dl
14.	Caria	3 cc	342 mg/dl	340 mg/dl	2mg/dl
15.	Rostiana	3 cc	497 mg/dl	450 mg/dl	47mg/dl
16.	Dalin	3 cc	114 mg/dl	112 mg/dl	2mg/dl +
					336.9:16 =21.0mg/dl

From the table above it is explained that there are differences in the results of examinations on serum directly with those that are delayed 2 hours. The amount of serum that was delayed 2 hours decreased compared to the amount of serum that was examined directly. Examinations that are carried out directly are more accurate than those that are postponed for 2 hours because the delay in checking blood glucose causes some of the glucose to be used for the metabolism of blood cells. Then added sodium fluoride (NaF) anticoagulant which can prevent glucose metabolism (Wulandari, 2015).

Plasma Examination

The next examination that is carried out is the examination of the patient's blood plasma. The following shows the results of the plasma examination in person and delayed 2 hours.

Table Examination of plasma that is directly delayed for 2 hours

No	Name	Total blood volume	Direct plasma examination	Plasma examination Delayed 2 hours	Decreased amount of serum
1.	Spiritual	3 cc	99mg/dl	67.9 mg/dl	3.1mg/dl
2.	account	3 cc	80 mg/dl	42.9 mg/dl	37.1mg/dl
3.	Ropo	3 cc	87 mg/dl	57.6 mg/dl	30.4mg/dl
4.	Amelia	3 cc	114 mg/dl	107 mg/dl	7mg/dl
5.	Pintamin	3 cc	87 mg/dl	86 mg/dl	1mg/dl
6.	Get up	3 cc	302mg/dl	300 mg/dl	2mg/dl
7.	Erpika	3 cc	100 mg/dl	87 mg/dl	13mg/dl
8.	Lau simo	3 cc	112 mg/dl	110 mg/dl	2mg/dl
9.	Siti	3 cc	495 mg/dl	350 mg/dl	145 mg/dl
10.	Arsiyati	3 cc	95 mg/dl	69mg/dl	26mg/dl
11.	Kartini	3 cc	87 mg/dl	57mg/dl	31mg/dl
12.	Ayet	3 cc	130 mg/dl	120 mg/dl	10mg/dl
13.	Marian	3 cc	200 mg/dl	180 mg/dl	20mg/dl
14.	Search	3 cc	310 mg/dl	308 mg/dl	2mg/dl
15.	Rostiana	3 cc	480 mg/dl	475 mg/dl	5mg/dl
16.	Dalin	3 cc	112 mg/dl	97mg/dl	15mg/dl +
					377.6 : 16 =23.6mg/dl

The percentage decrease in blood glucose levels in serum and plasma samples that were examined immediately and delayed for two hours. The percentage of reduction in blood glucose levels that was checked immediately and delayed for two hours can be seen in the appendix. From the calculation results of the percentage reduction in blood glucose that was checked immediately and delayed for two hours, serum was 21.0 as much as for plasma 23.6.

This decrease in plasma sample examination occurs because plasma contains fibrinogen and EDTA particles which can affect the results of blood glucose examination.

Contents of Discussion Results

This study aims to determine differences in temporary blood glucose levels by using plasma and serum samples and to determine the percentage decrease in temporary blood glucose levels. This data was obtained by comparing the results of random blood glucose

levels with serum and plasma samples and the percentage of results of a decrease in random glucose levels that were delayed for two hours. This research is a type of descriptive research that aims to make an objective picture of a situation, then statistical analysis is carried out to compare the two variants, and perform percentages.

Based on the study, the difference in blood glucose examinations using EDTA plasma samples and serum which was immediately checked and which was postponed for two hours where the serum level which was immediately checked was 100.8 mg/dl which was delayed 100.4 mg/dl and the plasma which was immediately checked 99 mg/dl and the delayed 67.9 mg/dl. This difference occurs because the use of plasma which is prone to mixing with erythrocytes will affect the results of the examination and different methods of separation. The serum sample is separated by letting the blood stay in the tube for a while, then the blood will clot and then will experience agglomeration as a result of the liquid being squeezed out of the clot, blood usually freezes within 10 minutes (Ministry of Health, 2010). In the manufacture of serum blood cells coagulate diffusely and become trapped in an extensive, contractive network of fibrin fibers. In the manufacture of plasma, blood cells are precipitated clearly at the bottom of the tube, such as the deposition of other particle suspensions (Sadikin, 2001).

The difference that occurs between serum and plasma is also due to the fact that in plasma there is still fibrinogen and there are also EDTA anticoagulant particles in the plasma so that it can affect the examination results whereas in serum samples there is no fibrinogen and no EDTA anticoagulant particles.

Based on the percentage decrease in blood glucose levels during the results of this study proves that a delay of two hours for blood glucose examination when there is a decrease in blood glucose levels after being left or postponed for examination at room temperature for two hours. A temporary drop in blood glucose levels that is delayed for two hours.

The average serum glucose level that was immediately checked was 100.8 mg/dL and the glucose level with serum that had not been separated from blood cells with a delay of 2 hours was 100.4 mg/dL.

The percentage decrease in blood glucose levels from the results of the study proved that serum samples that had not been separated from blood cells experienced a decrease in blood glucose levels after being left or suspended at room temperature for 2 hours. The decrease in blood glucose in the serum which was delayed for 2 hours with the condition of the serum sample that had not been separated from the blood cells decreased to 21.0 mg/dL. Based on the theory, delaying the examination time can cause a decrease in blood glucose levels. This is caused by glycolysis of blood cells where serum or plasma samples must be immediately separated from blood cells, because erythrocytes and leukocytes in the blood, even though they are outside the body, still break down glucose for metabolism (Widmann, 2009). This reflects that glucose activity still occurs even though it is outside the body. The decrease in blood glucose at room temperature decreased by 1-2% per hour. This is because delays in the examination can result in a decrease in blood glucose levels because some of the glucose will be used for the metabolism of blood cells (Sacher, 2012).

Serum is a clear yellow blood fluid that is free of cells and without fibrinogen because blood proteins have turned into fibrin nets and clump together with cells. Serum is obtained by letting blood in a tube coagulate without anticoagulants and then centrifuging to precipitate all blood cells (Sacher, 2004). Although serum does not contain fibrinogen, it still contains all other proteins such as albumin, globulin and prothrombin. the lack of protein content in the serum can affect the growth of bacteria, this can cause the glucose content in the serum to decrease. The research results obtained showed a higher decline than the results determined according to Sacher (2004),

The longer the delay in the examination, the lower the resulting blood glucose level. This is in accordance with what was written by Sacher (2006) that the temperature of the environment where blood is stored or before separation also affects the level of glycolysis. At refrigerator temperature, glucose remains stable for several hours in the blood. At room temperature, it can degrade 12% per hour. This decrease is not significant for laboratories that perform blood tests as soon as blood is received. However, when blood samples are sent to a remote reference laboratory, there can be a substantial decrease in glucose levels due to glycolysis by blood cells.

Meanwhile, glucose levels that are too low or called hypoglycemia when glucose levels are below 60 mg/dL, this condition usually occurs due to strict diets, fasting based on excessive exercise, for DM patients who get insulin injections without eating and blood glucose levels that exceed normal values are called hyperglycemia. , if this condition continues it will fall into diabetes mellitus or diabetes with glucose levels> 200 mg/dL (Munjariyani, 2009). Even though the results are still within the normal range of glucose levels, an examination we are required to provide reliable results which will later be used as a reference in diagnosing a disease. This can be realized if you can avoid mistakes to a minimum by paying attention to standard operating procedures,

From the Apriani and Alta Umami tests, the results showed differences in blood glucose levels in the plasma EDTA which were immediately examined 89.18 mg/dl which was postponed for 2 hours 86.60 mg/dl, and serum levels which were immediately checked 92.20 mg/dl delayed for 2 hours 89.54 mg/dl. After the Z-test, it can be concluded that there is no significant difference between blood glucose levels using EDTA plasma samples and those using serum samples. (Sacher, 2004).

CLOSING

Conclusion

In a study of differences in blood glucose level checks using EDTA plasma and serum samples which were immediately checked and which were delayed for 2 hours at Efarina Berastagi Hospital, a total of 16 people, the frequency based on gender was 75% female and 25% male. shows that more patients who check glucose levels are female than male, it can be concluded as follows. There are different differences between checking blood glucose levels using serum and plasma samples, so that checking blood glucose levels is better using serum samples than plasma plasma. Meanwhile, with a delay of 2 hours will experience a decrease in results that are different from those examined directly.

Suggestions

1. For laboratory personnel Examination of glucose levels should be done directly after the sample is obtained so that the results obtained are in accordance with the patient's body condition. This needs to be done to avoid erroneous results that can allow false highs and false lows.

2. For health analyst students to know how to check glucose properly and correctly and be able to know when is the right time to do a blood glucose check.

3. For more careful analysis in working on a sample of patients so that the results are more accurate.

REFERENCES

Bells. 2001. Blood glucose levels. Southern Medical Journal.

Bott. 2014. Determination of blood glucose levels. Igarss.

Department of health. 2005. chemical method of glucose examination. Health representative council RI.

Department of health. 2010. The difference between serum and plasma. Health representative council.

Djojodibroto 2003. Routine blood. Edition 27. Jakarta.

Dhania 2009. stress. Jakarta : EGC.

Evelyn C. Pearce. 2006 . Serum examination. The main library Gramedia.

Ganong. 2002. thyroid hormone. jakarta: salemba medika.

Hall 2007. stress. Jakarta : EGC.

Hardjoeno. 2003. blood glucose test. Jakarta: EGC

Hardjoeno 2003. Blood glucose test. Gramedia: Jakarta

Henriksen et al. 2009. blood glucose levels. Student Libraries: Yogyakarta

Holt .2010. diet. Translated by: Anugerah. P.Ed. 6. EGC Jakarta

H. Wiwik and HS Andi. 2008. Antibodies in the body. Denpansar: health polytechnic

Irawan. 2007. source of glucose. Student Libraries: Yogyakarta.

Jan Tambayong. 2001. blood glucose metabolism. Medical: Jakarta.

Joyce. 2013. Clinical Laboratory. Jakarta: EGC.

Republic of Indonesia Ministry of Health. 2011. Blood Clotting. Decree of the Minister of Health of the Republic of Indonesia.

Kee. 2003. postponement of checking blood glucose levels. jakarta. rinepka copyright

key. 2003. blood glucose metabolism. language translation: bandung

Nur Ilham, R., Heikal, M. ., Khaddafi, M. ., F, F., Ichsan, I., F, F., Abbas, D. ., Fauzul Hakim Hasibuan, A. ., Munandar, M., & Chalirafi, C. (2021). Survey of Leading Commodities Of Aceh Province As Academic Effort To Join And Build The Country. IRPITAGE JOURNAL, 1(1), 13–18. https://doi.org/10.54443/irpitage.v1i1.19

Nur ilham, R., Likdanawati, L., Hamdiah, H., Adnan, A., & Sinta, I. . (2022). COMMUNITY SERVICE ACTIVITIES "SOCIALIZATION AVOID STUDY INVESTMENT" TO THE STUDENT BOND OF SERDANG BEDAGAI. IRPITAGE JOURNAL, 2(2), 61–64. https://doi.org/10.54443/irpitage.v2i2.312

Falahuddin, F., Fuadi, . F., Munandar, M., Juanda, R. ., & Nur Ilham, R. . (2022). INCREASING BUSINESS SUPPORTING CAPACITY IN MSMES BUSINESS

GROUP TEMPE BUNGONG NANGGROE KERUPUK IN SYAMTALIRA ARON DISTRICT, UTARA ACEH REGENCY. IRPITAGE JOURNAL, 2(2), 65–68. https://doi.org/10.54443/irpitage.v2i2.313

Majied Sumatrani Saragih, M. ., Hikmah Saragih, U. ., & Nur Ilham, R. . (2021). RELATIONSHIP BETWEEN MOTIVATION AND EXTRINSIC MOTIVATION TO ICREASING ENTREPRENEURSHIP IMPLEMENTATION FROM SPP AL-FALAH GROUP AT BLOK 10 VILLAGE DOLOK MASIHUL. MORFAI JOURNAL, 1(1), 1–12. https://doi.org/10.54443/morfai.v1i1.11

Sandi, H. ., Afni Yunita, N. ., Heikal, M. ., Nur Ilham, R. ., & Sinta, I. . (2021). RELATIONSHIP BETWEEN BUDGET PARTICIPATION, JOB CHARACTERISTICS, EMOTIONAL INTELLIGENCE AND WORK MOTIVATION AS MEDIATOR VARIABLES TO STRENGTHENING USER POWER PERFORMANCE: AN EMPERICAL EVIDENCE FROM INDONESIA GOVERNMENT. MORFAI JOURNAL, 1(1), 36–48. https://doi.org/10.54443/morfai.v1i1.14

Sinurat, M. ., Heikal, M. ., Simanjuntak, A. ., Siahaan, R. ., & Nur Ilham, R. . (2021). PRODUCT QUALITY ON CONSUMER PURCHASE INTEREST WITH CUSTOMER SATISFACTION AS A VARIABLE INTERVENING IN BLACK ONLINE STORE HIGH CLICK MARKET: Case Study on Customers of the Tebing Tinggi Black Market Online Store. MORFAI JOURNAL, 1(1), 13–21. https://doi.org/10.54443/morfai.v1i1.12

Ilham, Rico Nur. et all (2019). Investigation of the Bitcoin Effects on the Country Revenues via Virtual Tax Transactions for Purchasing Management. International Journal of Suplly Management.Volume 8 No.6 December 2019.

Ilham, Rico Nur. et all (2019).. Comparative of the Supply Chain and Block Chains to Increase the Country Revenues via Virtual Tax Transactions and Replacing Future of Money. International Journal of Suplly Management.Volume 8 No.5 August 2019.