Description of Blood Glucose Levels in Cataract Patients

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Abstract. Vision is one of the factors that are very supportive in our daily lives; vision can be achieved well through the eye. It consists of various parts which are support each other if there is a disturbance in one part, the eye function will not work properly. One of the causes of eye disorders is the occurrence of turbidity in the part of the eye lens which is commonly called cataract. Cataracts can occur due to an increase in high blood glucose levels and the accumulation of one component of glucose (sorbitol) in the area of the lens. Research has been carried out on the description of blood glucose levels in cataract patients at the Cicendo Eye Hospital in Bandung on June 5 - June 8, 2017. The purpose of the research is to find out the blood glucose description in cataract patients. The method of the research is a descriptive. The examination performed by using fasting blood glucose parameters on 36 cataract patients as respondents. Based on the results of the research, 2.7% had low blood glucose levels, 47.3% had normal blood glucose, and 50% had high blood glucose levels.

1. Introduction
Eye is one of five senses that is very important in human life. If the eye has disorder or disease, it will have fatal consequences for of the 2013 Riskesdas (Basic Health Research) survey, the highest number of blindness in human life. Vision impairment is a condition characterized by a decrease in visual acuity or a decrease in the field of view, which can lead to blindness.

According to Global data on visual impairment 2010, World Health Organization (WHO) 2012, the estimated number of people with visual impairments worldwide in 2010 was 285 million people or 4.24% of the population, amounting to 0.58% or 39 million people experiencing low vision. 65% of people with visual impairment and 82% of people with blindness are over 50 years old. The cause of most vision problems is caused by refraction problems followed by cataracts and glaucoma. While the cause of most blindness worldwide is caused by cataracts, followed by glaucoma and AMD (Age related Muscular Degeneration). Based on the results Indonesia was in Central Java, East Java and West Java while the least was in North Maluku, Papua and West Papua. The highest number of low vision servers was in the Provinces of East Java, Central Java, and West Java, while the least was in West Papua, West Sulawesi and North Maluku Provinces. (InfoDATIN; 2014)

One of the causes of blindness or visual impairment is cataract. Cataract is a turbidity that arises on the lens, which is normally transparent. Normally, the lens is a refractive device that will help focus the
light converging so that it can fall right in the macula. The existence of turbidity in the lens, the incoming light will be lit or even inhibited so that it cannot be passed to the retina. Turbidity in the lens can occur due to hydration of the lens, lens protein denaturation or a result of both (Ilyas, 1999: 207). Usually turbidity affects both eyes and progresses or can change not for a long time.

Aging is the most common cause of cataracts, but many other factors may be involved, including: trauma, toxins, systemic diseases (such as diabetes), smoking, hereditary. Diabetes mellitus (DM) is a group of metabolic diseases in which a person has high blood glucose, either because insulin production is inadequate, or because the body's cells do not respond well to insulin, or for both reasons.

Diabetes mellitus can damage the eyes and interfere with vision. There are three main complications in the eye caused by Diabetes Mellitus, namely Retinopathy, Cataracts and Glaucoma. (Diabetic cataract; 2011).

As is known, in people who have diabetes, the body cannot produce insulin (blood glucose controlling hormone) or the insulin produced is insufficient or insulin does not work properly. Therefore, it will cause blood glucose increased when examined. Increased blood glucose levels can affect lens clarity, refractive index, and accommodation ability. Also, it will increase glucose levels in the aqueous humor. Glucose from the aqueous enters the lens through diffusion where a portion of this glucose is converted to sorbitol by the enzyme aldose reductase through the polyol pathway, which is not metabolized and stays in the lens. In condition where sorbitol is broken into fructose by the enzyme Polyol Dehydrogenase, however in Diabetes Mellitus levels, the enzyme Polyol Dehydrogenase are low so that sorbitol accumulates in the lens of the eye. Hypertonic conditions will draw in aqueous fluid into the eye lens, damage the lens architecture and cause lens turbidities. (JKS 2011; 1: 42-47).

2. Methods
Method of the research is descriptive. Samples were taken from cataract patients who were being treated at Cicendo Bandung PMN Hospital. The samples were 36 respondents. They asked to fill the questionnaire provided. Samples taken were venous blood, then prepared into serum examined for blood glucose levels. Examination was done in the form of fasting blood glucose parameters which is determined by the following formula:

\[
N = \frac{n}{1 + n(d^2)}
\]

Explanation:
N : Number of Sample
n : Total of Sample
d : Level of Confidence
It is known;
n = 307 patients
d = 0.025 %

Number of Sample;
\[
N = \frac{307}{1+307 (0.025)^2}
\]

N = 36 samples
3. Result and discussion

Table 1. Percentage of Blood Glucose Examination Result on Cataract Patients

| No | Blood Glucose Level | Total | (%) |
|----|---------------------|-------|-----|
| 1  | Low                 | 1     | 2.7 |
| 2  | Normal              | 17    | 47.3|
| 3  | High                | 18    | 50  |
|    | Total               | 36    | 100 |

Figure 1. Graph of Fasting Blood Glucose Examination Results

The results of research and data processing on the description of blood glucose levels in 36 cataract patients at the National Eye Center Cicendo Bandung Eye Hospital who use fasting blood glucose with a normal value of 70 - 110mg / dl. Based on the results of the examination are obtained a number of 1 patient or 2.7% had a low blood glucose level of <70 mg / dl, 17 patients or 47.3% had a normal blood glucose level that is between 70-110 mg / dl, and as many as 18 patients 50% have high blood glucose levels > 110 mg / dl.

The results of the examination with low blood glucose levels obtained on 1 patient with a sample code (22) had a fasting blood glucose level of 63 mg / dl. Patients aged 62 years, from the previous questionnaire answers, patients had a history of diabetes for less than one year and have a history of cataracts in less than a year, do not experience trauma or falls, not taking oral diabetes drugs and in the treatment of cataracts. This condition is where blood glucose levels are below normal values (below 70 mg / dl), called hypoglycemia. Hypoglycemia is a health disorder that occurs when blood sugar levels are below normal levels. Sugar is obtained from foods that we digest and absorb. These sugar molecules enter the bloodstream and are then channeled to all cells in the body's tissues. But most of the body's cells cannot absorb sugar without the help of the insulin hormone produced by the pancreas. In this case, insulin acts as a door opening for the entry of sugar into the cell. If the amount of insulin is too much, blood sugar levels will automatically decrease. That is why hypoglycemia is experienced by diabetics because they often use insulin or drugs that trigger insulin production to reduce sugar levels in their blood. But not only insulin can reduce blood sugar levels, there are several other factors, such as poor diet and excessive exercise, can also lead hypoglycemia.

Then the factors can be caused by diabetes and the age factor of patients. People with age more than 60 years old tend to range from cataracts because of advanced age often decline in vision function. In 17 cataract patients amounted to 47.3% with normal blood glucose levels with an average of 93.8 mg / dl. From the 17 patients, 3 patients with the sample method (12, 34, 36) the results of questioners’ answers were known to have normal blood glucose levels with a history of diabetes for more than one
year, under the treatment of diabetes, had a history of cataracts for more and less from one year and did not have trauma or falls. This condition is where the normal blood glucose level of a patient is caused by the consumption of antidiabetic drugs consumed by the patient, where the antidiabetic drug has a variety of ways of working and the chemical composition depends on the class of antidiabetic drugs, some stimulate the pancreas to produce more insulin, others work to reduce insulin resistance, while others inhibit absorption of carbohydrates in the intestine. It can also be caused by the condition of patients who are healthy when they are examined for blood glucose levels so that a normal value can be obtained even though they have a history of diabetes. Then cataracts patients, due to the length of diabetes experienced by patients more than one year, in people who have diabetes the occurrence of complications in the visual senses, especially cataracts are very susceptible to occur, because in this condition there is accumulation of sorbitol in the area of the lens, which cannot be degraded by insulin.

In the other 14 patients with sample codes (1, 3, 5, 13, 15, 17, 18, 20, 23, 24, 25, 28, 31, 33), the results of normal blood glucose testing, no history of diabetes had a history of cataracts for less than a year, did not experience trauma or falls. The age of patients with the sample code is on average more than 50 years of age, then the cataract disease suffered by the patient can be caused by aging, while in other patients whose age is in the age of 50 years, the trigger factor is cataract can be caused by genetic factors, skin diseases, infections, or the use of certain drugs.

Based on the results of fasting blood glucose from 18 patients by 50% of cataract patients were found to have high blood glucose levels (exceeding 110 mg / dl) with an average fasting blood glucose level of 217.2 mg / dl. Circumstances where blood glucose levels high is called hyperglycemia, out from 18 patients there were 6 patients with sample code (9, 10, 11, 27, 29, 30), no history of diabetes, had less than one year of cataract, had no trauma or fall , except patients with sample code 11 had previously experienced a fall. The high level of fasting blood glucose in these nondiabetic patients can be influenced by several trigger factors, among others, from the consumption of foods that contain lots of sugar, the activity being undertaken, the length of fasting that the patient carries out before the time of sampling, or the presence of internal factors such as hormone production abnormalities, the presence of disease in the pancreas or other diseases.

Cataracts patients can occur due to the age of patients who are over the age of 50 years or have entered the elderly, except in the number 11 which is 43 years old and previously known to have experienced a fall in the eye area, the occurrence of cataracts in these patients caused by trauma that has been experienced by the patient so that an injury to the inside of the eye arises and cataracts occur.

Then in 12 other patients with sample codes (2, 4, 6, 7, 8, 14, 16, 19, 21, 26, 32, 35) high blood glucose levels were found, with a history of diabetes for more than one year, duration of cataracts for less than one year in the sample code (4, 6, 7, 8, 14, 16, 26, 32, 35), and less than one year in the sample (2, 26, 21). Hyperglycemia that occurs in these patients due to a history of diabetics, in the condition of diabetes there is damage in the pancreatic organs so that the insulin hormone was not produced properly or even not produced at all. Therefore the level of glucose in the blood cannot be controlled and there is increasing blood glucose.

Cataract patients occur due to several factors, but one of them is caused by complications from diabetes, in diabetes conditions the body cannot produce insulin (blood glucose controlling hormone) or the insulin produced is insufficient or insulin does not work properly. Therefore, it will cause blood glucose increased when examined. Increased blood glucose levels can affect lens clarity, refractive index, and accommodation ability. Also, it will increase glucose levels in the aqueous humor. Glucose from the aqueous enters the lens through diffusion where a portion of this glucose is converted to sorbitol by the enzyme aldose reductase through the polyol pathway, which is not metabolized and stays in the lens. In condition where sorbitol is broken into fructose by the enzyme Polyol Dehydrogenase, however in Diabetes Mellitus levels, the enzyme Polyol Dehydrogenase are low so
that sorbitol accumulates in the lens of the eye. Hypertonic conditions will draw in aqueous fluid into the eye lens, damage the lens architecture and cause lens turbidities. (JKS 2011; 1: 42-47)

4. Conclusion
Based on the results of fasting blood glucose examination in 36 cataract patients at the National Eye Center Laboratory, Cicendo Eye Hospital was obtained 1 patient or 2.7% had low blood glucose, 17 patients or 47.3% had normal blood glucose levels, and 18 or 50% of patients had high blood glucose levels.

5. References
[1] AnreasPollreiszdanUrssula Schmidt-Erfurth, Jurnal of Ophthamology, “Diabetic Cataract pathogenesis”, 2010.
[2] BadanLitbangkesKementrianKesehatan. RisetKesehatanDasar. 2013
[3] DitjenBinaFarmasidanAlkes, FarmasiPerawatanUntukPenyakit Diabetes Melitus; DepartemenKesehatanRI, Jakarta, 2005.
[4] Gondhowiardjo TD, AktivitasEnzimAldehidDehidrogenasepadaLensaKatarak Diabetes dan Non Diabetes; OphthalmologicalIndonesiana. 1996.
[5] Guntrur, Marias, Mardionodkk, IlmuPenyakit Mata UntukDokterUmum Dan MahasiswaKedokteran, CV. SagungSeto; Jakarta, 2010.
[6] Guyton 1995, FisiologiMekanismepenyakit.BukuKedokteran EGC, Jakarta
[7] Lee, Joyce le Fever (ed), PedomanPemeriksaanLaboratoriumndandiagnostik. Dialihbahasakanoleh : Sari Kurnianingsih. EGC.Jakarta, 2007.
[8] Lukitasari AI” JurnalKedokteranSyah Kuala Volume 11 ”JurnalKatarak Diabetes, 2011.
[9] Pusat Data danInformasiKementrianKesehatanRI.SituasiGangguanPenglihatandan Kebutaan.2014.Price, Sylvia. A, Lorraine, M. Wilson, Buku 1 PatofisiologiKonsepKlinis Proses-Proses Penyakit, edisi : 4. Jakarta : EGC, 1995.
[10] TamsuriAnas, KlienGangguan Mata danPenglihatanKeperawatanMedikalBedah, PenerbitBukuKedokteran EGC; Jakarta, 2012.
[11] Tiokroprawiro.HA.Dkk, Diabetes Mellitus AspekKlinik Dan Epidemiologi; UniversitasAirlangga, Surabaya, 1986.
[12] WorldHealthOrganization.SituasiGangguanPenglihatandanKebutaan, InformasiKementrianKesehatan RI, Jakarta Selatan, 2014.
[13] World Health Organization, Global Data on Vision. 2010

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