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# Effect of Alkaline Water Consumption on Decreasing Blood Sugar Levels of Diabetes Mellitus Patients

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## ABSTRACT

Day by day the number of patients with diabetes mellitus is increasing. In this case, patients must always take medication in order to control their blood sugar levels. In the community, it was found that there were still many patients who were unable to control their sugar levels because they were bored to take medical drugs. One alternative therapy that has become a trend now is to consume alkaline water (pH = 8.5 - 9.5). The purpose of this study was to determine the effect of alkaline water consumption on blood sugar levels of diabetes mellitus patients in the working area of Tulang Bawang 1 Health Center, Tulang Bawang Regency. This research was a pre-experimental study with one group pre-post test design approach. The population of this study were all people suffering from diabetes mellitus in the work area of the Tulang Bawang 1 Health Center, with a population size of 86 people. The sample size was 50 people selected by purposive sampling technique. The collected data was presented descriptively in the form of mean values, then the hypothesis was tested using T-Test. The mean blood sugar levels of the patients before being given the intervention were 285.58 gr/dl. The mean blood sugar levels of the patients after being given the intervention (2 liters of alkaline water for 1 week) were 233.34 g/dl. It was known that there has been an average decline in blood sugar levels of 51.84 gr/dl. T-test shows that p-value was 0.000 (<0.001), so it was interpreted that alkaline water consumption can reduce blood sugar levels in diabetes mellitus patients in the working area of Tulang Bawang 1 Health Center, Tulang Bawang Regency. It is recommended that further research be carried out to find out more about the most effective fluid time and volume. In addition, people are expected to consume alkaline water as an alternative therapy in order to control blood sugar levels.

**Keywords:** Diabetes mellitus, Blood sugar, Alkaline water

## INTRODUCTION

Indonesia is currently experiencing a double burden of diseases, namely non-communicable diseases and infectious diseases. The main non-communicable diseases include hypertension, diabetes mellitus (DM) cancer and chronic obstructive pulmonary disease (COPD)<sup>(1)</sup>. According to the World Health Organization (WHO) report, from the estimation of the International Diabetes Federation (IDF), there were 382 million people living with diabetes in 2013. By 2035, this

number is expected to increase to 592 million<sup>(2)</sup>. The prevalence of DM in Indonesia is based on the results of Basic Health Research in 2012 which was 1.1% and in 2013 increased to 2.4%. In addition, mortality due to diabetes mellitus in the 45-54 year age group in urban areas is ranked second, namely 14.7%, while in rural areas, DM is ranked sixth, namely 5.8%<sup>(3)</sup>. DM prevalence in Lampung Province based on the results of Basic Health Research has increased. The prevalence of DM for ages > 15 years according to doctor's diagnosis or according to existing symptoms, based on the results of Basic Health Research is 0.5% percent in 2012, then increased to 0.8% in 2013<sup>(3)</sup>.

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DM complications can be either acute complications or chronic complications. Acute complications include hypoglycemia, diabetic ketoacidosis and non ketotic hypermolar, whereas chronic complications include macrovascular complications, microvascular

complications and neuropathy<sup>(4)</sup>. Complications of DM have started early before the diagnosis of DM is established. About 50% of patients when diagnosed with DM, have suffered one chronic complication, 21% of them have retinopathy, 18% have abnormal ECG images and 14% have impaired blood flow to the legs so that the pulse of the leg is not palpable or ischemic in the limbs arises. Various complications of DM will reduce life expectancy by about 15 years, 75% of them die from macrovascular complications.

Apart from complications, another problem faced by DM patients is high maintenance costs. According to Hartini, in developed countries such as the United States in 2011, the total health budget spent on dealing with DM was US \$ 174 billion for 25.8 million people suffering from DM. WHO estimates that the majority of countries around the world spend 2.7 to 15 percent of their health budget for DM. In 2006, the ROSSO study (Retrospective Study Self-Monitoring of Blood Glucose and Outcome in People with type 2 Diabetes) by Weber, reported that expenditure by DM patients increased year by year, along with the rate of complications experienced. In the first year after being diagnosed, DM patients spend IDR 18.3 million a year, up to IDR 49.1 million in the eighth year<sup>(5)</sup>.

To avoid complications and expensive maintenance costs, it is necessary to manage DM in an integrated manner called the pillar for managing diabetes. The four pillars of DM management are: 1) diet, 2) physical exercise, 3) pharmacology or drug use, 4) education. DM management aims to provide support for DM patients to live with a risk of minimal or no risk of complications, with specific targets for blood sugar, fat and body weight. For pharmacological management of DM, chemical drugs or herbal medicines can be used. Herbal medicines that are well-known to the public include pare/*Momordica charantia*, Garlic/*Allium sativum*, Lager flower/*Lemna stroemia speciosa pers*), acupunctur, acupressure, therapeutic aroma and alkaline water.

Herbal therapies using alkaline water are currently in great demand by the public, because they only drink water. Alkaline water or hydrogen-rich water, is currently a trend in medical practice in Indonesia. The basis used in this therapy is that hydrogen contained in water will enter the body and bind various harmful substances such as free radicals<sup>(6)</sup>.

Ionized alkaline water is known to act as an antioxidant because it can prevent oxidative stress from

the body's cells by exposure to oxidants every day, which can continue to damage various levels of cells<sup>(7)</sup>.

Tulang Bawang 1 Health Center is one of the health centers in Tulang Bawang Regency, Lampung Province, Indonesia, with the highest number of DM diseases compared to other health centers in the Tulang Bawang Regency. This disease is always included in the top 10 non-communicable diseases that people often complain about. Based on data from Tulang Bawang 1 Health Center, it was found that the number of DM patients in 2015 was 67 and increased in 2016 to 86<sup>(8)</sup>. Based on the results of interviews with 20 DM patients who came for treatment at the Tulang Bawang 1 Health Center in July 2017, all patients said that they had to take DM drugs and inject insulin continuously. This causes boredom, so patients sometimes ignore the obligation to take DM medication, which results in uncontrolled blood sugar levels. They want another alternative treatment to control blood sugar levels easily, cheaply and practically.

## MATERIALS AND METHOD

The type of this research was quasi-experimental with the design of "The One Group Pre-Test and Post-Test". This research was conducted on 13 to 20 November 2017 in the working area of Tulang Bawang 1 Health Center, Tulang Bawang Regency, Lampung Province, Indonesia. The population of this study was all DM patients in the working area of Tulang Bawang 1 Health Center, with a population size of 86 people<sup>(8)</sup>. The sample size was 50, which was calculated based on the unpaired categorical analytic formula. The sample was chosen by purposive sampling technique. The collected numerical data was presented descriptively in the form of mean scores<sup>(9)</sup>, then the hypothesis was tested using T-Test.

## FINDINGS

The results of random blood sugar levels were explained before and after alkaline water therapy was given (Table 1 and Table 2).

**Table 1: Distribution of results of random blood sugar levels before alkaline water therapy**

Variable	Mean	SD	Min	Max
Random Blood Sugar	285.58	87.462	201	570

Based on table 1 it is known that the average random blood sugar level was 285.58 mg/dl. In general, before

being given alkaline water therapy, people with DM had blood sugar levels  $\geq 200$  mg/dl.

**Table 2: Distribution of results of random blood sugar levels after alkaline water therapy**

Variable	Mean	SD	Min	Max
Random Blood Sugar	233.74	79.378	96	460

<sup>3</sup> Based on table 2 it is known that the average random blood sugar level was 233.74 mg/dl. It appears that there was a decrease in blood sugar levels after being given alkaline water therapy.

**Table 3: Distribution of Random Blood Sugar Check Results Before and After Given Alkaline Water Therapy**

Random Blood Sugar	Mean	SD	SE	P-value	n
Before	285.5	87.46	13.36	0.000	50
After	233.7	79.37	11.226		

Based on table 3, it can be seen that the mean results of random blood sugar examination after being given alkaline water therapy were lower than the average blood sugar level before being given therapy. The t-test results showed p-value = 0.000 so it was concluded that there was an effect of giving alkaline water to random blood sugar levels of DM patients.

## DISCUSSION

The results showed that before being treated with alkaline water, all DM patients had random blood sugar levels  $> 200$  mg/dl. Price and Wilson state that DM is a chronic hyperglycemia condition that affects the entire body system. This situation is caused by factors that inhibit the work of insulin or the amount of insulin decreases<sup>(4)</sup>. According to Smeltzer and Bare, DM is a group of heterogeneous disorders characterized by hyperglycemia or increased levels of glucose in the blood. Glucose normally circulates in a certain amount in the blood. Glucose is formed in the liver from food consumed. DM is characterized by an increase in random blood glucose ie  $> 200$  mg/dl (11.1 mmol/L). In DM patients, the body's ability to react to insulin can decrease, or the pancreas can stop insulin production altogether. Insulin is a hormone produced in the pancreas, which functions to control glucose levels in the blood by regulating its production and storage<sup>(4)</sup>.

<sup>5</sup> Based on the results of one study it was also known that the average blood sugar level of DM patients before being given alkaline water therapy was 285.58 mg/dl, while the average blood sugar level after being given alkaline water therapy for one week with a volume of 2 liters per day was 233.74 mg/dl. It was seen that there was a decrease in the average blood sugar level of 51.84 mg/dl.

According to Angela, alkaline water with a pH of 8.5 to 9.5 produced by ionizers can help alkalizing body tissues so that it can improve overall health. This alkaline water helps rinse acidic waste from around the pancreas and from inside the body. In addition, alkaline water also provides ionized calcium, which can prevent excess buildup of protein in the blood vessels. Alkaline water serves as an alternative therapy in managing DM patients with high blood sugar levels<sup>(11)</sup>. According to Jatmiko, complementary therapies that can be used for the treatment of DM are alkaline water, which is currently a trend in medical practice in Indonesia. The basis used in this therapy is the entry of hydrogen contained in water into the body and binding various harmful substances such as oxygen radicals<sup>(6)</sup>.

The results of this study are in line with the results of a study conducted by Gadek, which provides alkaline water to DM patients<sup>(12)</sup>. The results of this study indicate that 45% of patients experienced improvements in HbA1c and blood sugar. In fact, he reported that Number Need to Treat (NNT) is 4, which means that it requires the consumption of alkaline water in 4 patients to reduce HbA1c levels and blood sugar in 1 patient. The results of this study are also in line with the results of a study conducted by Li et al., that alkaline water is able to protect pancreatic  $\beta$  cells from damage after consuming alloxan. He concluded that alkaline water might be useful for preventing Type I DM<sup>(13)</sup>.

In this study, consumption of alkaline water is done by using it as a substitute for daily drinking water for 1 consecutive week, with a dose of 2 liters per day will cause changes in blood sugar levels. The majority of DM patients after being given alkaline water experienced a decrease in blood sugar levels, 40% of respondents even the results of examination of blood sugar levels showed normal values ( $<200$  mg/dl). This shows that consumption of alkaline water has a positive impact on decreasing blood sugar levels in patients with diabetes mellitus.

<sup>6</sup> The results of this study are in line with Wahyuningtiyas's statement that alkaline water is an antioxidant because it can reduce and prevent oxidative stress from body cells by exposure to oxidants every day,



which can continue to damage various levels of cells. Apart from being an antioxidant, because the content of water molecules is relatively smaller, water molecules will be easier to diffuse into cells. Thus, the cell hydration process will be easier to occur<sup>(7)</sup>.

Kajiya conducted a study of DM patients who were given alkaline water. He concluded that alkaline water supplementation may have a beneficial role in the prevention of Type 2 DM and insulin resistance<sup>(14)</sup>.

It is assumed that alkaline water can help regulate the absorption of blood sugar into the body through the work of the pancreas. Alkaline water has a high pH, which means it can neutralize acidic conditions in the body because the size of small molecular clusters of water in alkaline water is easier to use by cells in order to help hydrate and remove acidic toxins. At the same time, alkaline water contains bicarbonate ions which are very easy to use by the pancreas to help work the pancreas. The pancreas plays an important role in helping to maintain the alkalinity in the body, alkaline water can help the pancreas work, namely by helping maintain the pH balance of body fluids and improve the work of the pancreas in producing insulin, resulting in a decrease in blood sugar levels.

Based on the results of the study, it is known that some DM patients after being given alkaline water still have high blood sugar levels. This may be caused by several factors: 1) the blood sugar level before therapy is already too high, so that the time of 1 week and the liquid volume of 2 liters per day is insufficient to reduce blood sugar levels to normal conditions; 2) non-compliance with DM patients in maintaining their diet, this can be caused by low educational background and advanced age, so that there is difficulty in absorbing the information given; 3) inability to cope with stress, as described above that stress will trigger the organs of the body to improve its work, thus affecting the imbalance of acid base and fluid in the body.

## CONCLUSION

Based on the results of the study concluded that alkaline water therapy can reduce blood sugar levels in DM patients. Thus, consumption of alkaline water can be considered as an alternative therapy for DM patients.

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**Ethical Clearance:** Yes

**Conflict of Interest:** No

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