UNIVERSITI TEKNOLOGI MARA

INVESTIGATIVE STUDY OF STRESS EFFECT ON CONTROL OF BLOOD GLUCOSE LEVEL

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ABSTRACT

Stress hormones such as cortisol, glucagon, epinephrine and epinephrine play an important role in affecting the blood glucose level in the human body. An increase in stress hormones can cause the blood glucose level to elevate and sudden increase of blood glucose level in patients body may lead to the occurrence of hyperglycemia when the blood glucose level is above the normal baseline. Thus, the objectives of this study are to determine the effect of stress on the control of blood glucose level and to simulate an algorithm to control the blood glucose level by using a Rudimentary model. However, the simulation work was focused solely on cortisol only and other stress hormones were neglected due to limited data. Therefore, mathematical modeling is utilized to maintain the blood glucose level within the normal range and reducing the hyperglycemia in the patient. Hence, a Rudimentary model by Rios-Guzman was chosen to simulate the algorithm by using MATLAB to control the blood glucose level. Application of *in-silico* method is carried out in controlling the glucose level by using a virtual approach. From the simulation, it was found that the elevation of blood glucose level was dependent on the infusion rate of the stress hormone. The focused was only on cortisol hormones during the simulation work because of the availability of data. The blood glucose level of the subject remained within the normal range for glucose level, thus, the subject does not have hyperglycemia or hypoglycemia. In conclusion, the blood glucose level can be controlled through the simulation by using MATLAB.

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CHAPTER 1

INTRODUCTION

1.1 Research overview

Diabetes or diabetes mellitus (DM) is a metabolic disorder prior to insulin deficiency or defective insulin action in the body. Thus, it affects the metabolism of carbohydrates and caused the blood glucose level to elevated. Diabetes consists of two which are Type 1 diabetes and Type 2 diabetes. Diabetes type 1 is a chronic autoimmune disease that caused insulin cannot be produced enough in the body. This condition normally diagnosed in children, however, it can occur to any age. Therefore, patients required to supplement insulin regularly for their treatment. On the contrary, Type 2 diabetes is a condition where the body created resistance to insulin and eventually reduce the production of insulin in the body. This is called insulin resistance. Type 2 diabetes usually is associated with hyperglycemia which blood sugar level is high in bloodstreams. It can be treat by taking insulin to keep the blood sugar level under control (Punthakee, Goldenberg, & Katz, 2013).

Hyperglycemia is one of the common diseases that mostly associated with critically ill patients (Paliosa, Teixeira, Rosa, & Blatt, 2017). It is usually observed on patients during hospitalization due to traumatic injury, a surgical operation or when having a serious illness. However, hyperglycemia is mostly correlated with patients that have no history of diabetes than patients with diabetes. Hyperglycemia is the term used when the blood glucose level is high (greater than 6.0 mmol/L) in the patient body. This occurs if the body develops a resistance toward insulin or there is not enough insulin release by the pancreas in the bloodstream. Prior to this, the insulin is unable to process glucose and caused the glucose to pile up which can harm the body, thus, may lead to fatal to a human.

On the other hand, insulin is an important hormone needed in the human body to help in maintaining the glucose level in the blood. When the blood sugar level is too high it can lead to hyperglycemia and if the blood sugar level is too low, it can