UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

MATHEMATICAL MODELLING FOR DETECTING DIABETES

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ABSTRACT

This paper works to formulate the blood glucose level of diabetes.Diabetes is a syndrome of disorder metabolism which due to combination of hereditary and environmental causes.Thus, its resulting in abnormally high blood sugar level.The two most common of diabetes are due to dependent of insulin (Type 1) and independent of insulin (Type 2). It will be explained how the hormones and insulin activated and how its effect glucose level in blood. In this research proposed a mathematical model for the study of diabetes which the subjects based in the results on the glucose tolerance test (GTT) of four to five hours. The model of interaction between glucose and insulin concentration in the body will be formulated and solved. Then, the parameter values can be obtained and substituted into general model to obtain the new predicted glucose concentration. Next, the best fit model for detecting diabetes can be determined. Hence, an indicator will be used which similar to the one that proposed by Osborne (2013) to diagnose a diabetic condition. There are three subjects that will be observed and the data of glucose concentration for each subjects are obtained based on GTT to check the accuracy of the model. As a result, Subject A is the best fit model while Subject C is the good model for detecting diabetes. Then, Subject B is not a good model to detect diabetes. In conclusion,the case of Subject B shows that the model can only be used for mild diabetes or pre-diabetes.

1 INTRODUCTION

1.1 Research Backgroud

Diabetes is a syndrome of disordered metabolism, due to the abnormally high blood sugar levels in your blood and urine. This is also due to the combination of hereditary and environmental causes.

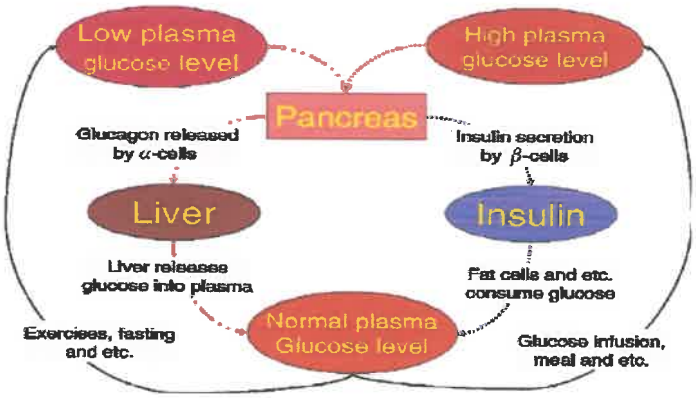

Figure 1.1: Physiological glucose-insulin regulatory system

Based on the figure 1.1, Schuit et al. (2001) the pancreatic endocrine hormones which are insulin and glucagon will keep the glucose concentration level in normal. The β-cells and α-cells in Langerhans islets are secreted the insulin and glucagon. When the increase in the blood glucose concentration level, the β-cells release insulin that can lowering the glucose concentration level in the body. When the blood glucose level decrease, the α-cells release glucagon that can increase the blood glucose level and the glucose will be released into the blood. The range 70 to 110 mg/dl of glucose concentration level show that the person have the problem in blood glucose which are hyperglycaemia or hypoglycaemia.

In type 1 diabetes or insulin-dependent diabetes which have no enough insulin that been produce in the body.It will cause high blood sugar level in the body. A person who have this disease need insulin for their entire life. It is also usually happen before 40 years old. This disease is happen about one in ten people.