Journal of Diabetes and Cholesterol Metabolism (DCM)

HENDUN RESEARCH ACCESS

Short Communication

Summary of Glucose Behavior Study Using GH-Method: Math-Physical Medicine Methodology

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Introduction

This article summarizes the author's research findings on postprandial plasma glucose (PPG) for the past 6-years from 2014-2019 with an emphasis on glucose behavior. Its purpose is to provide useful educational materials to healthcare professionals, specifically nutritionists and nurses, who are the frontline personnel in the management of diabetes.

Methods

In 2014, the author developed a metabolic mathematical model, including 10-categories within two general groups: body output (weight, glucose, blood pressure, lipids) and body input (food, water, exercise, sleep, stress, life routine). These 10-categories further contains ~500 elements and >1.5 million data [1]. He also applied his metabolic model to develop an accurate HbA1C prediction model. Starting in 2015, he developed weight and two glucose prediction models of FPG and PPG. He utilized signal processing techniques, wave theory, and energy theory, to decompose a measured PPG wave (i.e. curve) into 19 sub-wave components (i.e. influential factors) and achieved a prediction accuracy of 99.9%.

In 2017, he utilized optical physics and artificial intelligence (AI) to develop a non-invasive and an easy to use AI-based Glucometer for a patient to use daily via a smartphone or PC. This AI tool has only utilized eight influential factors which also provided a prediction accuracy of 99.5% [2]. In 2019, in order to further simplify his modeling and technology usage, he developed a two-factor based linear equation model and achieved a prediction accuracy of 99.0%. During the period from 5/5/2018 through 7/31/2019, he also collected additional >33,000 glucose data (*Sensor*) from a continuous blood glucose monitoring (CBGM) sensor applied to his arm along with his collected >10,000 daily glucose data since 2012 through the finger-piercing method (*Finger*). The sensor data provided an upper bound of PPG range, while the finger data provided a lower bound of PPG range [3].

Since 2017, he has extended his research scope from a diabetes focused study into its multiple complications, including CVD, stroke, renal, retinal, bladder, foot ulcer, etc. By 2019, not only is he able to calculate the risk probability of having CVD, stroke, or kidney problems due to diabetes, more specifically, through the removal of external stimulators of glucose, he is now able to guesstimate the general health state of the pancreas beta cells in terms of their insulin production capability.

Results

The enclosed figures validate his research results at different stages. In addition, he has numerous papers and clinical case reports which have demonstrated not only the effectiveness of his research methodology but also the various high accuracies of his prediction results [1-4]. In July of 2019, he has also presented his four clinical cases regarding the different degree of damage (i.e. health state) of pancreatic beta cells at two medical conferences in Europe. Figures 1-5.

Conclusions

The author believes that we should treat our "glucose" in a similar way to how parents treat their children. We must understand, guide, regulate, educate, and in some instances control the children in order to avoid trouble (disease complications) caused by them.

However, the author has seen very little effort made to understand "glucose" which is the source of diabetes disease and its numerous complications. Specifically, how many healthcare professionals truly understand the following:

Why, when, and how often do the glucose peaks occur?

How to bring down glucose levels and at what rate?

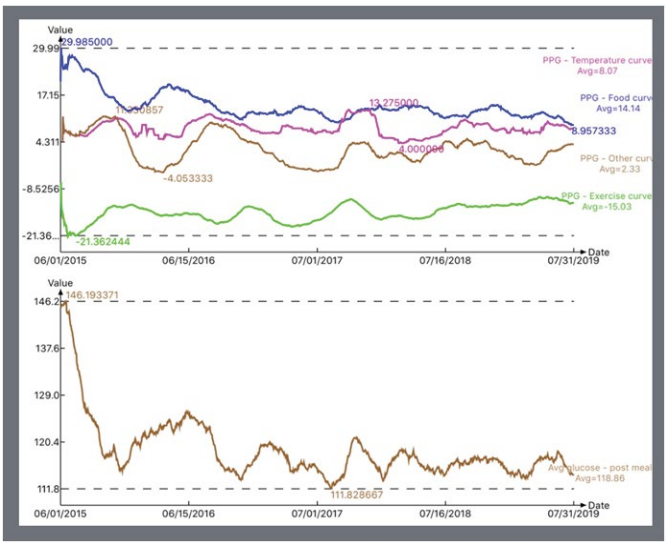

Figure 1: Measured PPG with 19 Influential Factors (developed in 2015 with accuracy 99.9%).

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Received: April 23, 2020**; Accepted:** May 04, 2020**; Published:** May 07, 2020

Figure 2: AI Glucometer with 8 Influential Factors (developed in 2017 with accuracy 99.5%).

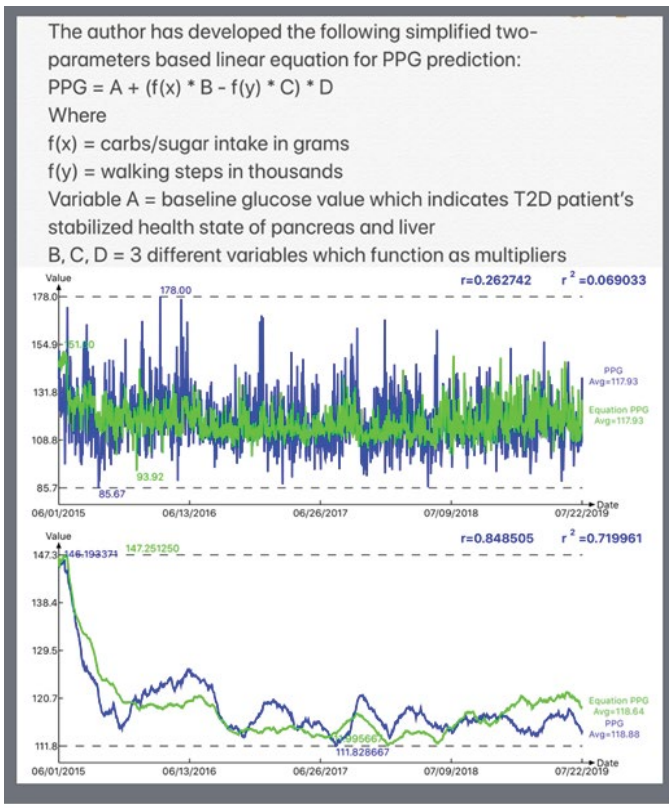


Figure 3: Two Parameters-based Linear Equation Model with 2 Influential Factors (developed in 2019 with accuracy 99.0%).

What type of and to what extent is the damage done on our internal organs caused by the excessive energy from high glucose components?

To control diabetes disease is similar on how to tame a mustang. You must understand the horse's natural characteristics in order to control its feral characters. Using a tranquilizer to calm the mustang is not the best and long-term solution. Therefore, the purpose of this article is to bring attention to the medical professionals, so they can do their part to truly understand the "glucose" behaviors from a fundamental level.

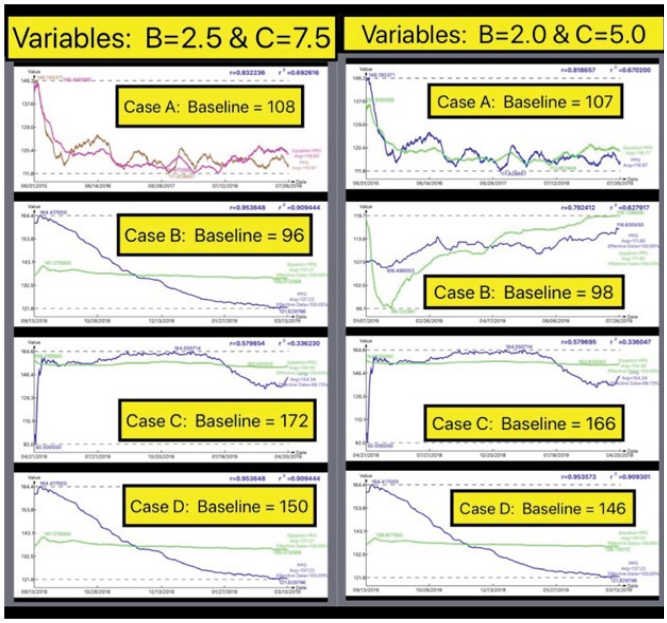
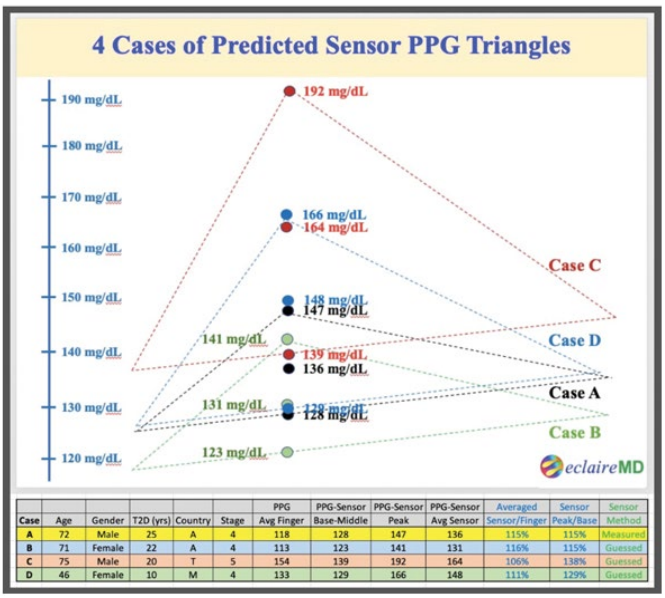


Figure 4: Lower bound of beta cells health state using Finger data.



Case	Age	Gender	T2D (yrs)	Country	Stage	PPG Avg Finger	PPG-Sensor Base-Middle	PPG-Sensor Peak	PPG-Sensor Avg Sensor	Averaged Sensor/Finger	Sensor Peak/Base	Sensor Method
A	72	Male	25	A	4	118	128	147	136	115%	115%	Measured
B	71	Female	22	A	4	113	123	141	131	116%	115%	Guessed
C	75	Male	20	T	5	154	139	192	164	106%	138%	Guessed
D	46	Female	10	M	4	133	129	166	148	111%	129%	Guessed

Figure 5: Upper bound of beta cells health state using Sensor data.

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