THE STUDY ON THE DAMAGE TO INTERNAL ORGANS AND THE PANCREATIC BETA CELLS HEALTH STATE DUE TO EXCESSIVE ENERGY ASSOCIATED WITH HIGH POSTPRANDIAL PLASMA GLUCOSE COMPONENTS AND DISTINCTIVE WAVEFORMS USING GH-METHOD: MATH-PHYSICAL MEDICINE

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INTRODUCTION

In this paper, the author analyzed and interpreted a type 2 diabetes (T2D) patient’s high glucose components of postprandial plasma glucose (PPG) waveforms. He further investigated the damage to his internal organs and the estimated relative health state of his pancreatic beta cells that resulted from excessive leftover energy associated with those high glucoses using GH-Method: math-physical medicine approach.

METHODS

The author has been a T2D patient for 25 years. He has collected his blood sugar values via a continuous glucose monitoring device (the “Sensor”) that was applied to his arm from the period of 5/5/2018 - 9/28/2019. As shown in Figure 1, during these 481 days, he has collected a total of 35,748 glucose data (total of 100%) with an averaged 74.32 collections per day. His big glucose data included 481 fasting plasma glucose (FPG) waveforms with 5,291 data (15% of total), 1,443 PPG waveforms with 18,759 data (52% of total), and 11,698 pre-periods glucose data (both pre-meals and pre-bed for 33% of total).

After collecting sufficient data, he has segmented those glucose data in the following segments:
(1) Different time instants and sub-periods to examine different glucose levels.
(2) Different glucose strengths, high glucoses of >140 mg/dL and > 180 mg/dL to calculate their associated energy which damaged the internal organs.
(3) Distinctive waveform patterns (i.e. shapes) with different degree of stimulation and physical characteristics of biological signals.

(4) Different time instants (0 and 180 minutes of PPG) and sub-periods (pre-meals and pre-bed), and FPG to examine the human body’s glucose production without any strong stimulators, such as food, exercise, etc. to examine the relative health state of the pancreatic beta cells.

RESULTS

In Figure 2, the author displays both composite and time instant detailed PPG curves which depict high glucose components of >140 mg/dL occupying 43% of total glucose data. However, those high glucose components carry a higher 45% of associated energy which circulates within the blood and causes damage to his internal organs.

In his published and presented papers, he has described his three distinctive PPG models known as *Himalaya, Twin Peaks, and Grand Canyon*. Each model represents different contribution from two key stimulators, i.e. food and exercise, along with showing different physical characteristics of bio-waveforms (i.e. PPG wave’s behavior). In Figure 3, it represents the following three *energy* contribution percentage by each distinctive PPG waveform (due to different styles of eating and exercising).

(A) Contribution margin of each pattern to composite waveform:

Grand Canyon: 46%

Twin Peaks: 42%

Himalaya: 12%

(B) Comparison among three patterns (both glucose area and square of glucose, see Figure 5)

Grand Canyon: 100%

Himalaya: 101-102%

Twin Peaks: 107-114%

As shown in Figure 5, he further analyzed and obtained the following high PPG components associated energy % of each distinctive PPG waveform pattern’s energy.

Twin Peaks: 48% of its energy

Grand Canyon: 29% of its energy

Himalaya: 10% of its energy
This means that the Twin Peaks pattern causes the most damage while Himalaya is better than Grand Canyon due to lower contributed Himalaya pattern and its tight control on carbs/sugar intake even under inactivity situation.

Finally, he re-examined his relative health state of pancreatic beta cells (the problem source of his T2D) by using his sensor big data (Figure 1) and GH-Method: math-physical medicine approach.

First, he calculated his average FPG during 00:30 to 07:45 with 11 measured data each day to have a level of 113 mg/dL, which is the lower bound of his condition. During sleep, there are very few stimulators to incite his glucose.

Second, he calculated the averaged pre-period glucose which include 24 measurements per day of both pre-meals period and pre-bed period. He has an averaged pre-periods glucose level of 121 mg/dL which represents his medium level of his condition. It should be noted that his glucose are somewhat higher than FPG due to his occasional fruit consumptions during these periods.

Finally, by applying his developed OHCA (Open-High-Close-Average) model, he connects the opening glucose (at 0-minute) and closing glucose (at 180-minute) and then calculates the glucose at 60-minute on this OHCA Triangular Baseline. He has an average glucose level of 129 mg/dL which represents the upper bound of his condition. The opening glucose is the result of his pre-meals activities and closing glucose is the result of this post-meal period’s total activities of both diet and exercise. It should be pointed out that pre-meals sub-period has an averaged 148 high glucose (>140 mg/dL) components with 9.6% of total pre-meals glucose data. This fruit induced excessive glucose would increase the “open glucose” of OHCA model somewhat; therefore, this upper bound level of 129 has been over-estimated which would bring his medium level of 121 to a slight lower level.

In summary, his relative health state of pancreatic beta cells is within the range of 113 and 129 with an average level around 121 or slightly lower (Figure 6).

When he calculates his predicted PPG, he could use 121 mg/dL as his starting position and then add on some glucose due to carbs/sugar intake and subtract some glucose due to post-meal exercise. This described calculation process actually depicts the basic idea of his “two-parameters based linear equation” of predicted PPG.
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Figure 1: Data window and Size.
Figure 2: Time-segmented PPG glucoses, high glucose components and their associated energy.
Figure 3: Associated energy with each 3 distinctive PPG composite waves.
Figure 4: Associated energy with 3 distinctive PPG detailed waves.
Figure 5: High glucose associated energy with each distinctive pattern.
CONCLUSIONS
Glucose is not just a medical term or a numerical number to indicate your blood sugar level. Actually, it contains lots of hidden information regarding the body’s biological behaviors.

This paper describes how to apply the segmentation method that discovered two extremely important health aspects for diabetes patients. First, we can estimate the diabetes complications due to the damage on the internal organs by excessive leftover energy associated with high energy components of PPG. Second, we can calculate the relative health state of pancreatic beta cells using character-segmented analyses of PPG and FPG detailed waves.
level of pancreatic beta cells in order to estimate a diabetes patient’s initial conditions. The above two biomedical facts can be identified and calculated via a detailed segmentation analysis of glucose (i.e. decompose “glucose”) without the complex, lengthy process of laboratory testing.

This paper further demonstrates the power and usefulness of GH-Method: math-physical medicine methodology for research on various chronic diseases and their complications.

REFERENCES


