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INTRODUCTION

This paper describes the results from the sensor glucoses collected by utilizing the continuous glucose monitoring (CGM) device and its segmentation analysis by using energy theory from mechanical engineering.

METHODS

Since 5/5/2018, the author has measured his glucose values using a CGM device on his upper arm and checked his glucose measurements ~80 times each day. For a duration of 703 days, from 5/5/2018 to 4/8/2020, he has collected 56,240 glucose data. He then segmented each day’s 80 data into the following seven subcategories:

1. Fasting FPG: 7.5 hours (23:30-07:00)
2. Breakfast PPG: 3.0 hours (07:00-10:00)
3. Pre-lunch: 2.0 hours (10:00-12:00)
4. Lunch PPG: 3.0 hours (12:00-15:00)
5. Pre-dinner: 3.0 hours (15:00-18:00)
6. Dinner PPG: 3.0 hours (18:00-21:00)
7. Pre-bed: 2.5 hours (21:00-23:30)

Total hours per day: 24 hours (23:30 previous day - 23:30 present day)

He has further assembled three PPG subcategories into one PPG category along with assembling pre-lunch subcategory and pre-dinner subcategory into a pre-meals category.

Here are the four categories:

1. FPG Category: 7.5 hours
2. PPG Category: 9.0 hours
3. Pre-meals Category: 5.0 hours
4. Pre-bed Category: 2.5 hours

After using the computer software to calculate the average glucose value for each glucose category, he has then multiplied the group's average glucose value with the time duration for each one (i.e. to obtain the area underneath glucoses curve during each category’s timespan) to get a relative energy level, which is associated with those individual glucoses within the time duration.

RESULTS

Figure 1 shows the daily average sensor glucose, 90-days moving average glucose, and the so-called “candlestick glucoses” during this period of 703 days. This unique “candlestick” model was created by a Japanese rice trader around 200 years ago and later imported by an American trader to be used by the Wall Street stock market in early 1990’s. In a single combined diagram, it displays five vital glucose values together, open day’s glucose, close day’s glucose, highest glucose, lowest glucose, and daily average glucose, which is similar to the five stock prices in one candlestick consisting of open price, close price, maximum price, minimum price, and average price.

Figure 2 illustrates the comparison of a synthesized (i.e. summarized) daily glucose chart from 23:00 of previous day throughout 23:00 of the present day, and the average glucose of seven subcategories chart. These two curves have a high correlation between them, but with some differences between straight lines connecting all of the average values and all of these detailed glucose data connection during each subcategory’s segment.

Figure 1. 3 kinds of Daily average glucose
Here are the seven calculated subcategory glucose values:

1. FPG: 113 mg/dL
2. Breakfast PPG: 136 mg/dL
3. Pre-lunch: 135 mg/dL
4. Lunch PPG: 139 mg/dL
5. Pre-dinner: 132 mg/dL
6. Dinner PPG: 130 mg/dL
7. Pre-bed: 125 mg/dL

Daily average glucose: 130 mg/dL

The reason pre-meal glucose category is particularly close to PPG is that the author usually eats his daily fruits for essential nutrients and natural vitamin intake during the pre-meal timespan.

Figure 5 is the most important conclusive diagram of this particular paper. The calculated “relative energy” levels associated with each category’s average glucose are listed below.

(A) FPG Category: 850 (28%)
(B) PPG Category: 1215 (40%)
(C) Pre-meals Category: 668 (22%)
(D) Pre-bed Category: 312 (10%)

It should be pointed out that the combined period of PPG and pre-meals are contributing 62% due to food intake, while their total time span is 58% of a day. This 62% of glucose energy amount almost occupies 2/3 of the total glucose energy per day. In his previous research findings, the high energy associated with glucose will create more damage to the internal organs which will then lead into various diabetes complications.
Conclusions

The author was astonished to discover that his average pre-meal glucose value of 134 mg/dL was extremely close to his average PPG value of 135 mg/dL. If he had followed the traditional medical advice and common healthcare practice for the past 8 years by solely depending on the finger-piercing measurement method three times a day at two hours after his first bite of his meals, and did not apply the CGM device two years ago and measured his glucose value ~80 times a day (every 15 minutes during daytime), he would have never discovered this fact. Furthermore, in order to reduce his risk probability of having diabetes complications, he must focus on these two periods: PPG and pre-meals. His pre-meal glucose energy occupying 28% of the total glucose energy can be controlled more easily than the PPG period. If he can reduce his average pre-meal glucose, he can further improve his health conditions.

Based on the energy theory from mechanical engineering, a deeper understanding of the glucose energy distribution can be achieved by searching the sources that caused diabetes complications. From the author’s personal data analysis, it seems that another research project on how to reduce his pre-meal glucose is required.

References


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