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Research Article

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Using Wave Characteristic Analysis to Study T2D Patient's Personality Traits and Psychological Behavior (GH-Method: Math-Physical Medicine)

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Introduction

The author has contemplated a specific question:
Why do some type 2 diabetes (T2D) patients choose to face serious complications, including death, rather than change their lifestyle in order to control their diabetic conditions?

This paper provides his first attempt to understand the reasoning from a psychological viewpoint by using a quantitative wave characteristic analysis. It also links T2D patient's psychological issues and his physiological conditions together in a quantitative manner.

Method

The author collected 17,046 glucose data during a period of 241 days (5/5/2018-12/31/2018). At first, he decomposed and segregated these data into 723 postprandial plasma glucose (PPG) waveforms, and then re-integrated them into three distinctive general patterns based on wave characters, including frequency, period, wavelength, amplitude, and wave shape:

1. First pattern, Himalaya (lower frequency and very long period) has reached to a high peak and then maintaining at this plateau due to physical inactivity.
2. Second pattern, Grand Canyon (lower frequency and short period) has reached to a high peak but then decaying rapidly and stay at the trough due to "correct" amount and pattern of post-meal exercise.
3. Third pattern, Twin Peak (higher frequency and shorter period) has reached to a high crest (P1) and then dropping for a while but rising to a second but lower peak (P2) again due to insufficient post-meal exercise.

The height of glucose peak will reveal the patient's willpower on carbs/sugar intake control. However, the glucose wave pattern, particularly the waveform shape and decaying speed will disclose the patient's willpower and persistence on post-meal exercise control.

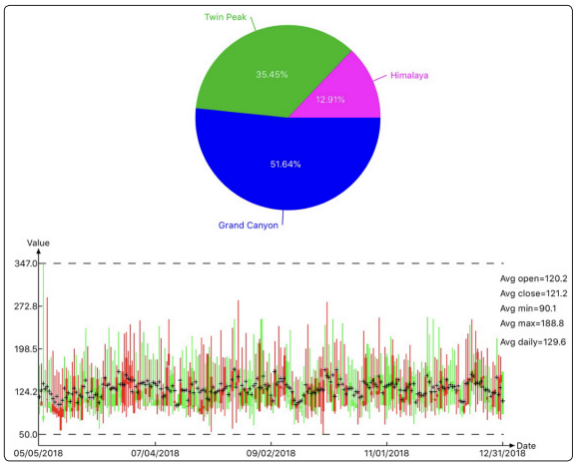

Figure 1: Pattern distribution (%) and daily glucose candlestick chart

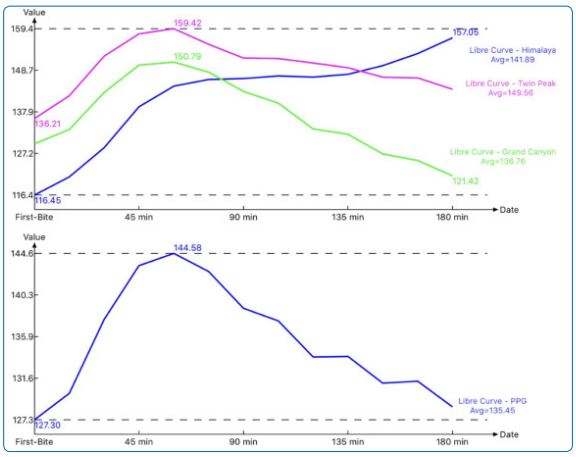

Figure 2: Three distinctive PPG waveforms shapes with average and peak glucose values (mg/dL)

Results

The list below includes the following:
Waveform Pattern distribution %, Peak glucose, and Average glucose.

Himalaya: 13%, 157, 142
Twin Peak: 35%, 159, 150
Grand Canyon: 52%, 151, 137

Effective average PPG: 136 mg/dL

Excessive energy from PPG: 36%
Increased CVD risk %: 1.7%
(From 26.4% to 28.1% based on 2017 data, or 6% increase on CVD risk)

1. Himalaya pattern (13% or 94 meals) includes 66% from air traveling (63 meals) and 34% from rainy days (31 meals).
2. Twin Peak pattern (35% or 256 meals) reveals that, initially, the patient lacked detailed knowledge on how to effectively combine both carbs/sugar and post-meal exercises (including both intensity and time span).
3. Grand Canyon pattern (52% or 373 meals) indicates that, most of the time, he has strong willpower and discipline to control both carbs/sugar intake and post-meal exercise.

Conclusion

This paper is more of a "forward-thinking" article. He believes that continuous glucose monitoring sensor devices will become popular and a big glucose data will be easily collected. Therefore, he is trying to lay the necessary groundwork for a future endeavor. Through analyzing those distinctive PPG waveforms, the personality traits and behavior psychological pattern of T2D patients can be revealed instantly and clearly. As a result, there will be a lesser need to collect and analyze big data of food and exercise for this purpose.

References

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