

The GH-Method

Comparison of Characteristics between FPG and PPG via Both Time-Domain and Frequency-Domain Analyses of GH-Method: Math-Physical Medicine (No. 019)

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Abbreviations: FPG: fasting plasma glucose; PPG: postprandial plasma glucose

1. INTRODUCTION

The author wants to revalidate his previous findings on glucose in time-domain through a frequency-domain analysis.

2. METHODS

2.1 Data collection and processing

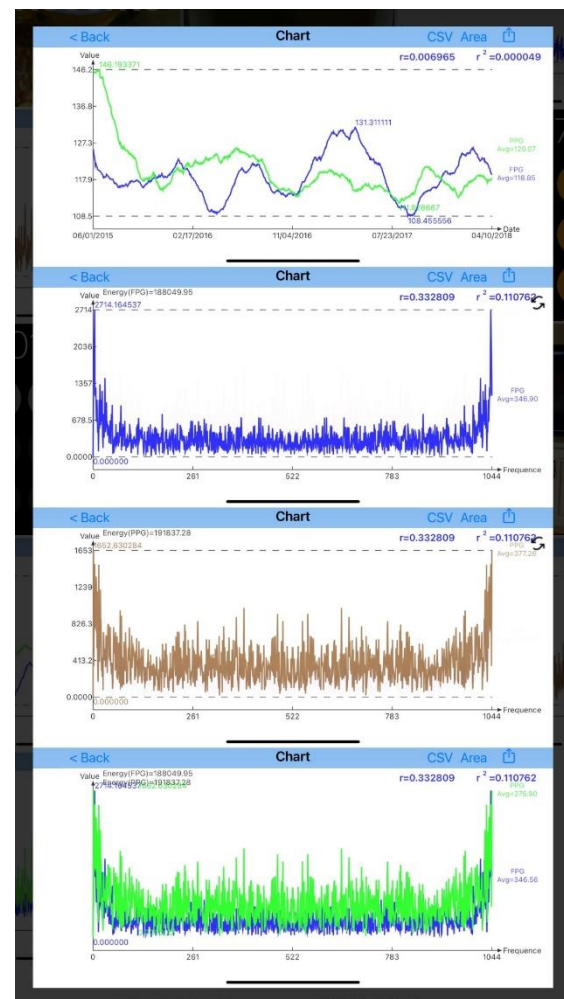
Approximately 1.5 million data points were collected and processed over a period of 1,046 days (6/1/2015 - 4/12/2018). The author employed mathematical, statistical, physics, engineering modeling, and computational tools, including big data analytics and artificial intelligence, to develop numerical simulation models. In this study, he specifically utilized Fourier Transform to convert two time-domain glucose waveforms into corresponding frequency-domain waveforms.

3. RESULTS

3.1 Time-domain analysis

Minimal correlation (0.7%) was observed between FPG (fasting plasma glucose) and PPG (postprandial plasma glucose), with FPG influenced by 5 factors with the primary factor of body weight (~80%) and PPG influenced by 19 factors including carbohydrate and sugar intake amount and post-meal exercise level (~80%). FPG values reflect the health status of a type 2 diabetes

(T2D) patient's pancreatic beta cells, which is also the key contributor to PPG formation.



3.2 Frequency-domain analysis

This dataset revealed a low correlation (33%) between FPG and PPG in the frequency domain. However, when excluding very low frequency components, the amplitude of the FPG waveform was noticeably smaller and more stable compared to the amplitudes of the PPG waveform in the frequency domain. This distinction can be attributed to the impact of the human body's slowed bio-rhythms during sleep on FPG, whereas PPG consistently experiences stronger influences from external factors like food, exercise, medications, stress, sleep, and sickness. Consequently, these external factors contribute to slightly higher PPG amplitudes in the frequency domain.

4. CONCLUSION

4.1 Energy contribution

FPG contributes a total energy of 82,272 (calculated as $188,050 * [7 \text{ hours} / 16 \text{ hours}]$), while PPG contributes a total energy of 107,908 (calculated as $191,837 * [3 \text{ times of } 3 \text{ hours each} / 16 \text{ hours}]$). Therefore, the effective energy ratio of PPG versus FPG is 1.31 (calculated as $107,908 / 82,272$).

In summary, FPG contributes 43% of the combined energy of FPG and PPG, while PPG contributes 57% of the combined energy of FPG and PPG. This 43% of energy contribution from FPG comes from both FPG itself during sleeping hours and its role as the baseline for PPG formation.