

Research Article

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A Simplified yet Accurate Linear Equation of PPG Prediction Model for Type 2 Diabetes Patients (GH-Method: Math-Physical Medicine)

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Received: May 05, 2020; Accepted: May 11, 2020; Published: May 15, 2020

Introduction

This paper describes a two-parameters linear equation for postprandial plasma glucose (PPG) prediction. The author developed this simplified yet highly accurate equation of predicted PPG to help type 2 diabetes (T2D) patients.

Methods

PPG contributes approximately 75% to 80% of HbA1C. Through the author's diabetes research, he has identified at least 19 influential factors associated with PPG formation. He further utilized 8 influential factors and artificial intelligence (AI) optical physics technology to develop an AI-based Glucometer APP to predict PPG. Whether the involved factors are 8 or 19, it is a complicated task for patients to learn, understand, or use in terms of their diabetes control. Among those factors, as indicated in his previous publications, carbs/sugar intake amount contributes ~38% and exercise contributes ~41% of PPG. In summary, these two primary influential factors contribute ~80% of the PPG formation.

Therefore, the author thought about developing a rather simplified two-parameters based linear equation to simulate the complex PPG. Initially, he derived a linear equation as follow:

Linear Equation of PPG = ((Baseline Glucose A) + (Carbs/Sugar grams * Variable B) - (Walking Steps / Variable C)) * Variable D

Based on the author's 9-year research findings, along with the acquired knowledge of food nutrition, the relationship between exercise and glucose, and using the trial and error approximation method, he developed the equation. After analyzing the big data of 1,493 days and 4,479 meals, he has finally identified a set of optimized combination of baseline glucose A, variables B, C, and D. He then further verified this equation's validity by calculating their linear accuracies (must be greater than 95%) and correlation coefficients (must be greater than 50%) between measured data versus both AI-based and Equation-based predictions.

Results

Table 1 shows the final results from this equation's calculation of predicted PPG. Its most important data are linear accuracy (based on daily glucose data) and correlation coefficients (based on 90-days moving averaged data) between measured PPG vs. AI predicted PPG and Equation predicted PPG, respectively.

(1) AI-based prediction has 99.95% accuracy (higher than Equation) and a 68% correlation (lower than Equation) due to its complicated biochemical inter-relationships among those 8 influential factors.

(2) Equation-based prediction has a lower yet 99.46% accuracy (slightly lower than AI) and a 75% correlation (higher than AI). This is due to its simplified model with only 2 primary influential factors (Table 1).

Table 1: Summary of accuracy and correlations of AI and Equation based PPG prediction

	Value (mg/dL)	Accuracy (Daily)	Correlation (90 Days)
Measured PPG	117.5165	Baseline	Baseline
Predicted PPG	117.4587	99.95%	68%
Liner Equation PPG	116.8851	99.46%	75%
Equation vs predicted			61%

(3) Variance of shapes from both time-series analysis and spatial analysis between Equation-based predicted PPG and Finger-piercing measured PPG have also shown their close relationship of moving trends (Figure 1).

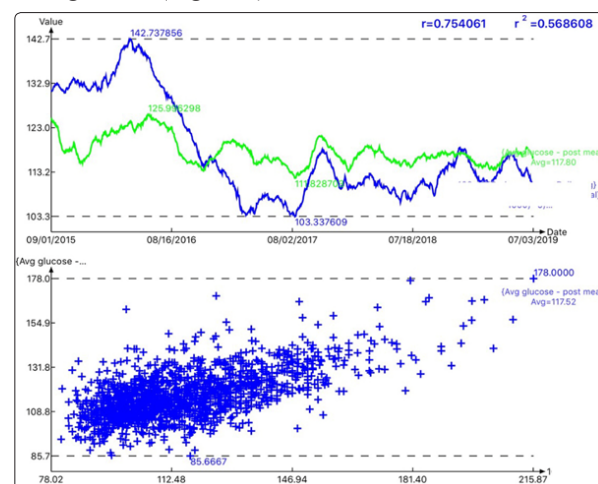


Figure 1: Equation-based PPG Prediction (time-series and spatial analysis)

(4) The correlation coefficient between AI and Equation is 61%, but it is high enough to prove the validity of this equation-based prediction model (Figure 2).

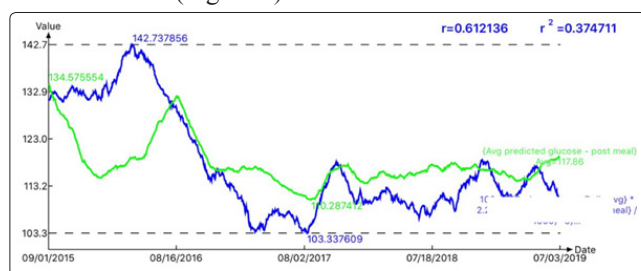


Figure 2: Comparison between AI-based and Equation-based PPG prediction models

Conclusion

This big data analytics derived two-parameters linear equation of PPG prediction model which is very simple for patients to use, while offering a high accuracy for PPG prediction. The author has been continuing his efforts to simplify his glucose prediction models in order to provide a simple and practical tool for T2D patients to use. By offering this streamlined process, the patients will be able to control their diabetes by removing certain resistance or reluctance [1-4].

References

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