

Using Regression Analysis Model to Explore the Relationship Between the Finger-Piercing Fasting Plasma Glucose at the Wake-Up Moment and Body Weight in the Early Morning over a 6.5-Year Period for a type 2 Diabetes Patient Based on GH-Method: Math-Physical Medicine (No. 556)

Gerald C Hsu

EclaireMD Foundation, USA

***Corresponding author**

Gerald C Hsu, EclaireMD Foundation, USA

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Note: Readers who want to get a quick overview can read the abstract, results and graphs sections.

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Abstract

The author began measuring his body weight at his wakeup moment in the early morning every day since 1/1/2012. In addition, he also measured his finger-piercing fasting plasma glucose (FPG) at the wakeup moment in the early morning starting on 1/1/2014.

By early 2017, he noticed that there was a tight connection between his finger-piercing FPG and body weight with correlation coefficients from 80% to >90%. Therefore, he decided to use his finger FPG as the dependent variable Y and weight as the independent variable X to conduct a space-domain regression analysis over a long period of 6.5-years from 7/1/2015 to 11/24/2021.

In this particular article, he compared the regression analysis results by using his semi-annual average data of both finger FPG and body weight.

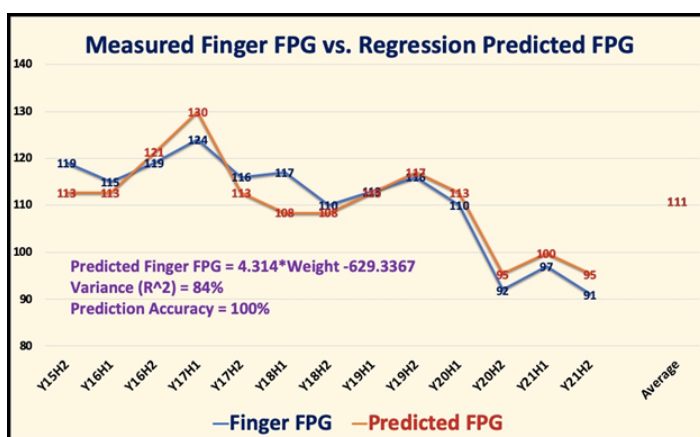
In summary, his finger FPG and Weight have an exceptionally **high correlation of 92% with a variance of 84%** using 13 semi-annual data over a period of ~6.5-years. Therefore, his regression predicted FPG and measured finger FPG also have a high variance of 84%. **The regression analysis results matched his previous findings regarding weight and FPG since 2017.**

The regression predicted finger FPG equation is:

$$\text{Predicted finger FPG (Y)} \\ = 4.314 * \text{weight (X)} - 629.336$$

The significance F and p-value are extremely small which means that **the data used in this study are statistically significant.**

Therefore, in the future, the author can guesstimate the fasting glucose value once he knows his body weight.



Introduction

The author began measuring his body weight at his wakeup moment in the early morning every day since 1/1/2012. In addition, he also measured his finger-piercing fasting plasma glucose (FPG) at the wakeup moment in the early morning starting on 1/1/2014.

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Methods

MPM Background

To learn more about the author's developed GH-Method: math-physical medicine (MPM) methodology, readers can select the following three papers from his ~500 published medical papers.

The first paper, No. 386 describes his MPM methodology in a general conceptual format. The second paper, No. 387 outlines the history of his personalized diabetes research, various application tools, and the differences between biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 depicts a general flow diagram containing ~10 key MPM research methods and different tools.

In particular, paper No. 453 illustrates his GH-Method: math-physical medicine in great details, "Using Topology concept of mathematics and Finite Element method of engineering to develop a mathematical model of Metabolism in medicine in order to control various chronic diseases and their complications via overall health conditions improvement".

His case of T2D and Complications

The author has been a severe T2D patient since 1996 and weighed 220 lbs. (100 kg, BMI 32.5) at that time. By 2010, he still weighed 198 lbs. (BMI 29.2) with an average daily glucose of 250 mg/dL (HbA1C of 10%). During that year, his

triglycerides reached to 1161 (diabetic retinopathy or DR) and albumin-creatinine ratio (ACR) at 116 (chronic kidney disease or CKD). He also suffered five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding his needs of kidney dialysis treatment and future high risk of dying from severe diabetic complications. Other than cerebrovascular disease (stroke), he has suffered most known diabetic complications, including both macro-vascular and micro-vascular complications.

In 2010, he decided to launch his self-study on endocrinology, diabetes, and food nutrition in order to save his own life. During 2015 and 2016, he developed four prediction models related to diabetes conditions: weight, postprandial plasma glucose (PPG), FPG, and A1C. As a result, from using his developed mathematical metabolism index (MI) model in 2014 and the four prediction tools, by end of 2016, his weight was reduced from 220 lbs. (100 kg, BMI 32.5) to 176 lbs. (89 kg, BMI 26.0), waistline from 44 inches (112 cm, nonalcoholic fatty liver disease /NAFLD) to 33 inches (84 cm), average finger glucose reading from 250 mg/dL to 120 mg/dL, and lab-tested A1C from 10% to ~6.5%. One of his major accomplishments is that he no longer takes any diabetes medications since 12/8/2015.

In 2017, he has achieved excellent results on all fronts, especially his glucose control. However, during the pre-COVID period of 2018 and 2019, he traveled to approximately 50+ international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control, through dining out frequently, post-meal exercise disruption, jet lag, and along with the overall metabolism impact due to his irregular life patterns through a busy travel schedule; therefore, his glucose control and overall metabolism state were somewhat affected during this two-year heavy travel period.

During 2020 and 2021 with a strict COVID-19 quarantine lifestyle, not only has he written and published ~400 medical papers in 100+ journals, but he has also reached his best health conditions for the past 26 years. By the beginning of 2021, his weight was further reduced to 165 lbs. (BMI 24.4) along with a 6.1% A1C value (daily average glucose at 105 mg/dL), without having any medication interventions or insulin injections. These satisfactory results are due to his non-traveling, low-stress, and regular daily life routines. Due to the knowledge of chronic diseases, practical lifestyle management experiences, and his developed various high-tech tools, they contributed to his excellent health status since 1/19/2020, which is the start date of being self-quarantine.

On 5/5/2018, he applied a CGM sensor device on his upper arm and checks glucose measurements every 5 minutes for a total of ~288 times each day. He has maintained the same measurement pattern to present day. In his research work, he uses the CGM sensor glucose at time-interval of 15 minutes (96 data per day). Incidentally, the difference of average sensor glucoses between 5-minute intervals and 15-minute intervals is only 0.4% (average glucose of 114.81 mg/dL for 5-minutes and average glucose of 114.35 mg/dL for 15-minutes with a correlation of 93% between these two sensor glucose curves) during the period from 2/19/20 to 8/13/21.

Therefore, over the past 11 years, he could study and analyze the collected ~3 million data regarding his health status, medical conditions, and lifestyle details. He applies his knowledge, models, and tools from mathematics, physics, engineering, and computer science to conduct his medical research work. His medical research work is based on the aims of achieving both “high precision” with “quantitative proof” in the medical findings.

The following timetable provides a rough sketch of the emphasis of his medical research during each stage:

- 2000-2013: Self-study diabetes and food nutrition, developing a data collection and analysis software.
- 2014: Develop a mathematical model of metabolism, using engineering modeling and advanced mathematics.
- 2015: Weight & FPG prediction models, using neuroscience.
- 2016: PPG & HbA1C prediction models, utilizing optical physics, AI, and neuroscience.
- 2017: Complications due to macro-vascular research such as cardiovascular disease (CVD), coronary heart disease (CHD) and stroke, using pattern analysis and segmentation analysis.
- 2018: Complications due to micro-vascular research such as CKD, bladder, foot, and eye issues such as DR.
- 2019: CGM big data analysis, using wave theory, energy theory, frequency domain analysis, quantum mechanics, and AI.
- 2020: Cancer, dementia, longevity, geriatrics, DR, hypothyroidism, diabetic foot, diabetic fungal infection, linkage between metabolism and immunity, and learning about certain infectious diseases such as COVID-19.
- 2021: Applications of linear elastic glucose theory (LEGT) and perturbation theory from quantum mechanics on medical research subjects, such as chronic diseases and their complications, cancer, and dementia. Using metabolism and immunity. It's as the base, he expands his research into cancers, dementia, and COVID-19. In addition, he has also developed a few useful analysis methods and tools for his medical research work.

To date, he has collected nearly 3 million data regarding his medical conditions and lifestyle details. In addition, he has written 556 medical papers and published 500+ articles in 100+ various medical journals, including 7 special editions with selected 20-25 papers for each edition. Moreover, he has given ~120 presentations at ~65 international medical conferences. He has continuously dedicated time and effort on medical research work to share his findings and knowledge with patients worldwide.

Regression Analysis Models

In this study, he will not repeat the detailed introduction of the regression analysis in the Method section because it is available in many statistics textbook. It should be noted that in regression analysis, the correlation coefficient R should be > 0.5 or 50% to indicate a strong inter-connectivity and the p-value should be < 0.05 to be considered as statistically significant.

Results

Figure 1 displays his input data and regression analysis output data for 13 semi-annual body weight measurements and finger FPG values over a 6.5-year period from 7/1/2015 to 11/24/2021.

11/24/21	Y	X	11/24/21	Y	X
Period	Finger FPG	Weight	Period	Finger FPG	Predicted FPG
Y15H2	119	172	Y15H2	119	113
Y16H1	115	172	Y16H1	115	113
Y16H2	119	174	Y16H2	119	121
Y17H1	124	176	Y17H1	124	130
Y17H2	116	172	Y17H2	116	113
Y18H1	117	171	Y18H1	117	108
Y18H2	110	171	Y18H2	110	108
Y19H1	113	172	Y19H1	113	113
Y19H2	116	173	Y19H2	116	117
Y20H1	110	172	Y20H1	110	113
Y20H2	92	168	Y20H2	92	95
Y21H1	97	169	Y21H1	97	100
Y21H2	91	168	Y21H2	91	95
Average	110.7	171.5	Average	111	111
Correlation	100%	92%	Correlation	100%	92%
Variance	100%	84%	Variance	100%	84%

SUMMARY OUTPUT					
Regression Statistics					
Multiple R					92%
R Square					84%
Adjusted R Square					82%
Standard Error					4.484224416
Observations					13

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1139.578276	1139.578276	56.67212318	0.00001
Residual	11	221.1909548	20.10826862		
Total	12	1360.769231			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-629.3366834	98.31023801	-6.401537583	0.00005	-845.7160584	-412.9573085
Weight	4.314070352	0.573063148	7.528088946	0.00001	3.052766867	5.575373837

Figure 1: Input data and regression analysis output data

The two diagrams in Figure 2 illustrate his regression analysis results.

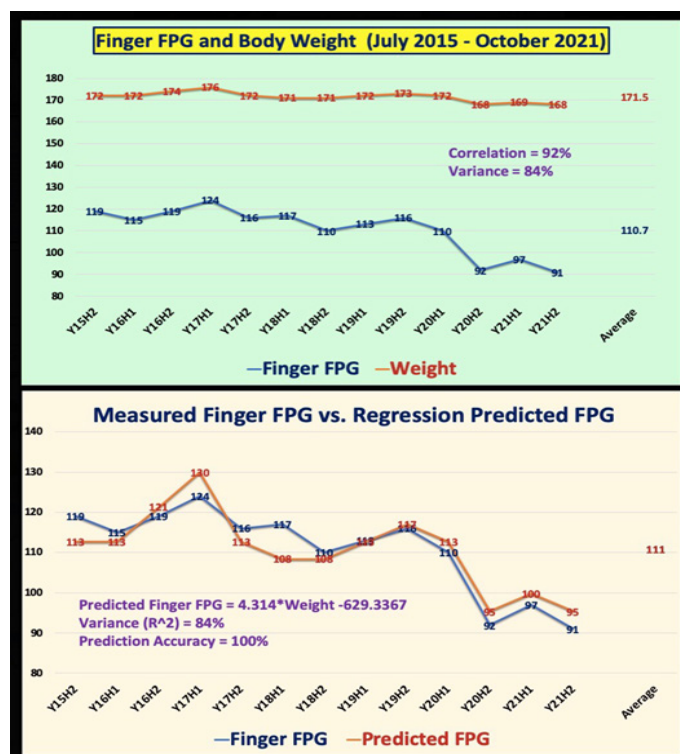


Figure 2: Measured finger FPG and weight (top diagram) and comparison of measured finger FPG vs. regression predicted finger FPG (bottom diagram)

The top diagram demonstrates his measured finger FPG data and measured body weight for 13 semi-annual periods. These two curves have *an exceedingly high correlation of 92% and a high variance of 84%*.

The bottom diagram shows the comparison of his measured finger FPG versus the regression predicted FPG. These two curves have a high variance of 84% and an average FPG's prediction accuracy of 100%.

The regression predicted finger FPG equation is expressed as follows:

$$\text{Regression predicted finger FPG} \\ = 4.314 * \text{body weight} - 629.3367$$

Conclusions

In summary, his finger FPG and Weight have an exceptionally *high correlation of 92% with a variance of 84%* using 13 semi-annual data over a period of ~6.5-years. Therefore, his regression predicted FPG and measured finger FPG also have a high variance of 84%. *The regression analysis results matched his previous findings regarding weight and FPG since 2017.*

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References

For editing purposes, majority of the references in this paper, which are self-references, have been removed for this article. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

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