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Research Article

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Probable Partial Self-Recovery of Pancreatic Beta Cells Using Various Glucose Data (GH-Method: Math-Physical Medicine)

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Introduction

In this paper, the author describes his hypothesis on the probable self-recovery of partial insulin regeneration capacity of pancreatic beta cells of a type 2 diabetes (T2D) patient via his collected data of both postprandial plasma glucose (Finger PPG and Sensor extended baseline PPG) and fasting plasma glucose (Finger FPG) during the period of 1/1/2014 to 4/5/2020.

Methods

The author has had T2D for 25 years and took various diabetes medications to control his elevated glucose levels starting in 1998. For the last 20 years, he has suffered from many T2D complications, including five cardiac episodes, foot ulcer, and renal/bladder complications; however, he did not have a stroke. In 2013, he started to reduce his three prescribed diabetes medications dosage. On 12/8/2015, he finally ceased his last remaining medication, the classic metformin HCL. For more than four years, his body has been free of any diabetes medications or insulin injections.

Since then, he has completely relied on a stringent lifestyle management program to control his diabetes conditions.

Here are the six rules of his lifestyle management program:

1. Eat <15 grams of carbs/sugar each meal and keep a balanced nutritional menu.
2. Walk >4,000 steps (2 miles or 3 kms) per meal and ~18,000 steps per day.
3. Drink ~3,000 cc water each day.
4. Sleep >7 hours each night.
5. Live an almost "stress-free" life.
6. Keep a simple, regular daily life routine and pattern.

As a result, his HbA1C has been reduced from 10% in 2010, while taking three different diabetes medications, to ~6.63% during 2016-2019 without any medication or use of insulin injection (Figure 1).

He has kept 2 million data of his own medical conditions and lifestyle details. He also developed a sophisticated computer software by using big data analytics and artificial intelligence to analyze, process, and manage this massive health data.

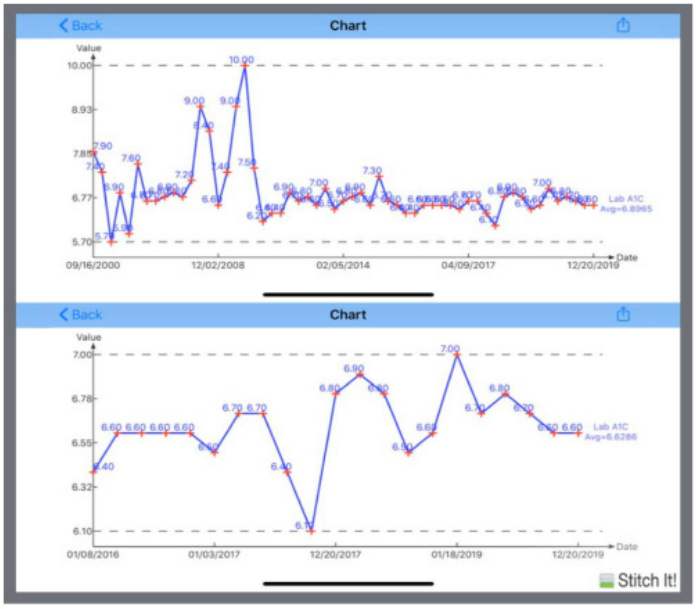

Figure 1: HbA1C history (2000-2019 and 2016-2019)

To summarize prominent findings from the glucose data analysis based on his observations for the past 4 to 5 years, he has noticed two "opposite" phenomena. For the first observation, his peak PPG value around 60-minutes, after the first bite of his meal, occasionally reaches to 200-300 mg/dL when he does not follow his stringent diet and exercise rules. This explicitly shows his existing degree of diabetes severity in terms of insulin resistance or lack of insulin production supply. For the second observation, from checking his massive data since 2014, his natural health state of pancreatic beta cells seems to be on a recovery path somewhat, even though it might be on a small scale.

Recently, he read an article online, "Diabetes: Can we teach the body to heal itself?" on Medical News Today, which was published on January 8, 2019. Here is an excerpt:

"A new study by researchers from the University of Bergen in Norway, Maria Cohut, Ph.D. and Luiza Ghoul, suggests that, with just a small "push," we may be able to train the body to start producing

adequate levels of insulin once more, on its own. The researchers were able, for the first time, to uncover some of the key mechanisms that allow cells to "switch" identity, looking specifically at pancreatic alpha- and beta-cells in a mouse model. They found that alpha-cells respond to complex signals they receive from neighboring cells in the context of beta-cell loss. Approximately 2 percent of alpha-cells can thus "reprogram" themselves and start producing insulin. By using a compound able to influence cell signaling in the pancreas, the researchers could boost the number of insulin-making cells by 5 percent."

The author's research methodology is a "math-physical medicine" approach, rather a "biochemical medicine" approach as used in the article above. Math-physical medicine approach has three key steps of research method. It starts with observing phenomena of some prominent physical characteristics from his collected big biomedical data. He then forms a reasonable hypothesis from these specific observations. Finally, if possible, he derives a few mathematical equations, to verify his hypothesis. Once verified, he can then use these prediction equations to reproduce future outcomes or final results.

In his presented papers No. 103, 108, and 133, he described his hypothesis and math-physical models to guesstimate the pancreatic beta cells health state by using a dataset including finger FPG as the lower bound, and PPG sensor extended baseline glucose as the upper bound. He applied his created OHCA (Open, High, Close, Average) Model of the Sensor PPG data during 5/5/2018 - 4/5/2020 to build a hypothetical extended sensor PPG model for the period of 1/1/2014 - 5/4/2018. Since the average sensor PPG is about 18% higher than Finger PPG, this is the reason the "extended baseline PPG" value serves as the upper bound of the research dataset.

Result

The author has collected both measured Finger FPG and PPG data from 1/1/2014 through 4/5/2020 for his recent beta cells study (Figures 2 and 3).

Figure 4 demonstrates the year to year change rates of FPG and PPG. Figure 5 shows a detailed calculation table.

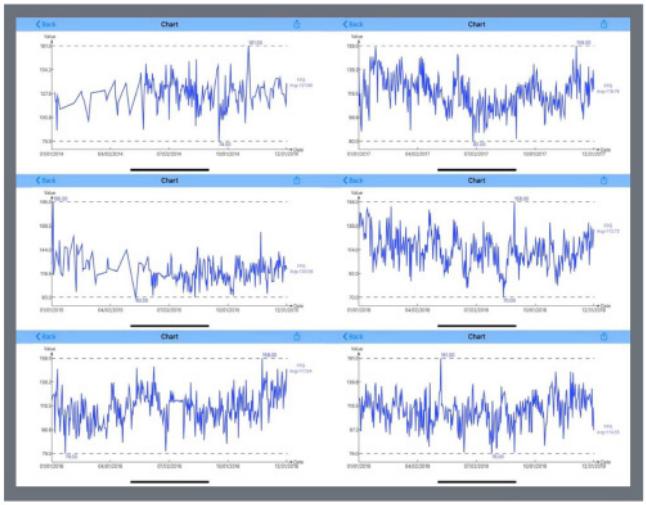

Figure 2: Annualized Finger PPG (2014-2019)

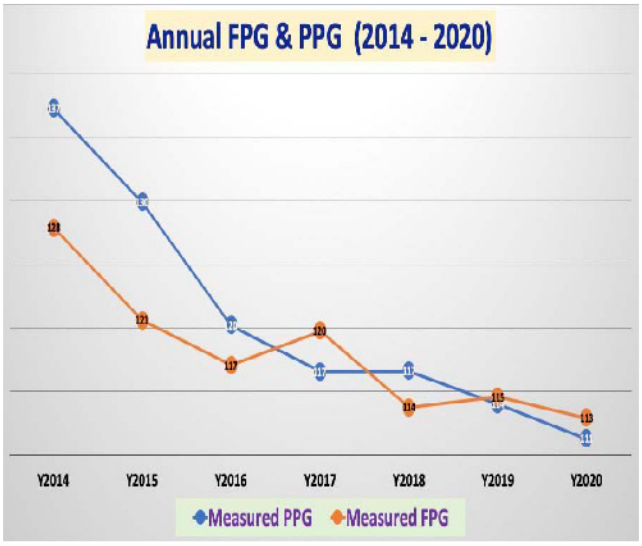

Figure 3: Summarized annual average Finger FPG and PPG (2014-2020)

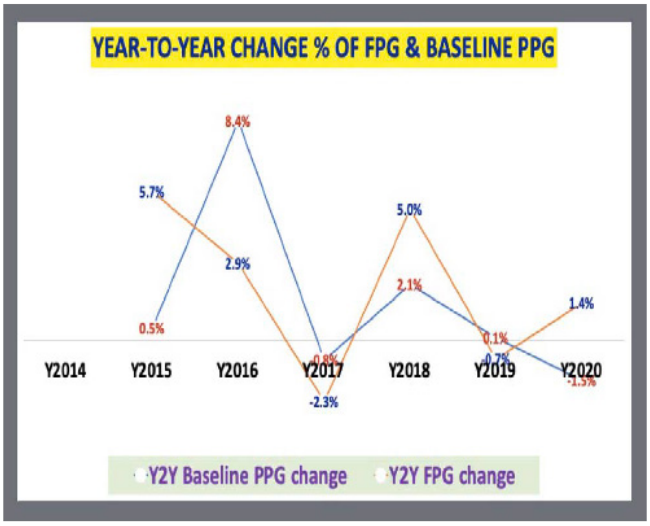

Figure 4: Annualized average Finger FPG and Baseline PPG changes % (2014-2020)

Year	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	Average
Measured PPG (mg/dL)	137	130	120	117	117	114	111	121
f(X): Carbs/Sugar per meal (grams)	16	14	15	14	15	13	13	14
f(Y): Post-meal Walking (Steps)	3000	3681	4110	4440	4538	4038	4623	4061
Measured FPG (mg/dL)	128	121	117	120	114	115	113	118
PPG Adjustment = f(X)*B-(f(Y)/1000)*C	20	13	13	9	11	9	5	12
Diet & Exercise contribution % on Measured PPG	15%	10%	11%	8%	10%	8%	4%	9%
A: PPG Baseline = Measured PPG - Adjustment	117	116	107	108	105	105	107	109
Measured PPG improvement = previous Y - current Y	NA	7	10	4	0	3	3	4
Baseline PPG improvement = previous Y - current Y	NA	1	10	-1	2	0	-2	2
(Measured PPG - 89) / 89 mg/dL	54%	46%	35%	31%	31%	28%	25%	36%
(Baseline PPG - 89) / 89 mg/dL; i.e. Beta cells health state	32%	31%	20%	21%	18%	18%	20%	23%
(Measured - Baseline) / 89 mg/dL	23%	15%	15%	10%	13%	10%	5%	13%
Y2Y Baseline change = (previous - current) / previous		0.5%	8.4%	-0.8%	2.1%	0.1%	-1.5%	1.5%
Y2Y FPG change = (previous - current) / previous		5.7%	2.9%	-2.3%	5.0%	-0.7%	1.4%	2.0%

Figure 5: Detailed calculation table for both PPG (2014-2020)

In his paper No. 133, he utilized annual Finger FPG to calculate a pancreatic beta cells self-recovery rate of 2.3% based on Finger FPG data from 1/1/2014 through 11/23/2019. However, after he updated his Finger FPG data from 1/1/2014 through 4/5/2020, a new pancreatic beta cells recovery rate of 2.0% from Finger FPG is revealed. In his paper No. 138, he utilized the OHCA Model to calculate a pancreatic beta cells self-recovery rate of 3.2% from the extended Sensor baseline PPG. Furthermore, in his paper No. 242, he calculated one more pancreatic beta cells self-recovery rate of 1.5% from Finger PPG. Therefore, now he can take the average value of these two different PPG cases to obtain a self-recovery rate of 2.4% from PPG.

In conclusion, for the period of 1/1/2014 through 4/5/2020, the combined FPG and PPG values are decreasing at a linear speed of 2.19% per year. As shown in Figure 6, the pancreatic beta cells self-recovery rate is 2.19% annually from FPG (Finger) and PPG (both Finger and Sensor extended baseline PPG).

Formula of annual self-recovery rate
= (FPG 2.0%*8/17) + (PPG 2.4%*9/17)
= 0.941%+1.244%
= 2.19% per year
Where 8 hours covering FPG and 9 hours covering 3 PPG.

Furthermore, the recovery rate of 2.19% is within the range of 2% from the reprogramed alpha cells to beta cells and 5% of the insulin-making increased amount as quoted from the research in Norway.

Contribution Glucose	Change %	Hours/Day	Hours %	Contribution %
Finger PPG change %	1.5%	9	38%	0.56%
Sensor extended baseline PPG change %	3.2%	9	38%	1.20%
Averaged PPG change	2.4%			
FPG change %	2.0%	8		0.94%
PPG change %	2.4%	9		1.24%
Annual beta cells "self-repairing" rate				2.19%

Figure 6: Conclusion of Annual pancreatic beta cells self-recovery rate of 2.19% (2014-2020)

Conclusion

The author observed vast improvement in his diabetes conditions after following a stringent lifestyle management since 2014, which was the same year he developed his mathematical model of metabolism index (MI). From examining his own glucose data over 8-years, he hypothesized that pancreatic beta cells are still able to "repair" themselves to a certain degree - self-recovery at an annual rate of 2.19% and ~13% over a 6-year period.

The author decided to write a few articles from his in-depth research to encourage other medical scientists to conduct similar work, even though they may use different research methods, to further explore this subject of "probable pancreatic beta cell's self-recovery" [1-5].

References

1. Hsu Gerald C (2018) Using Math-Physical Medicine to Control T2D via Metabolism Monitoring and Glucose Predictions. Journal of Endocrinology and Diabetes 1: 1-6.
2. Hsu Gerald C (2018) Using Math-Physical Medicine to Analyze Metabolism and Improve Health Conditions. Video presented at the meeting of the 3rd International Conference on Endocrinology and Metabolic Syndrome.
3. Hsu Gerald C (2018) Using Signal Processing Techniques to Predict PPG for T2D. International Journal of Diabetes & Metabolic Disorders 3: 1-3.
4. Hsu Gerald C (2018) Using Math-Physical Medicine and Artificial Intelligence Technology to Manage Lifestyle and Control Metabolic Conditions of T2D. International Journal of Diabetes & Its Complications 2: 1-7.
5. Hsu Gerald C (2018) A Clinic Case of Using Math-Physical Medicine to Study the Probability of Having a Heart Attack or Stroke Based on Combination of Metabolic Conditions, Lifestyle, and Metabolism Index. Journal of Clinical Review & Case Report 3: 1-2.