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Review Article

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# Guesstimate Probable Partial Recovery of Pancreatic Beta Cells Using Calculations of Annualized Fasting Plasma Glucose Decreased Amount (GH-Method: math-physical medicine)

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## Introduction

In this paper, the author describes his hypothesis on the probable partial self-recovery of some insulin regeneration capability of pancreatic beta cells on a type 2 diabetes (T2D) patient via his collected data of fasting plasma glucose (FPG) and body weight during the period of 1/1/2014 to 11/2/2019.

## Methods

The author has had T2D for 25 years and took various diabetes medications to control his elevated glucose levels since 1998. For the last 20 years, he has suffered many T2D complications, except for having a stroke. Starting from 2013, he reduced the dosages of his three prescribed diabetes medications. On 12/8/2015, he discontinued taking his last remaining medication, metformin HCL. 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) after each meal (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 T2D has been under control (HbA1C ~6.5%) since 2016 without any medication or use of insulin. He has kept nearly 2 million data of his own medical conditions and lifestyle details. He also developed a sophisticated computer software by using artificial intelligence to analyze, process, and manage his massive health data.

To summarize prominent findings from the glucose data analysis based on his past 4 to 5 years' experience, he has noticed two "opposite" phenomena. For the first observation, his postprandial plasma glucose (PPG) occasionally will reach to 200-300 mg/dL when he does not follow his stringent diet and exercise rules. This shows the existing severity of his diabetes conditions in terms of insulin resistance or lack of insulin supply. For the second observation, from checking his massive data since 2014, his natural health state of pancreatic beta cells seems to be recovered 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 "math-physical medicine", not "biochemical medicine" as used in the above article. Math-physical medicine has three key steps of research methodology. He starts with observing some prominent physical phenomena from his collected biomedical big data. He then forms a reasonable hypothesis from his specific observations. Finally, he derives a few mathematical equations, if possible, to verify his hypothesis. Once verified, he can then use the same equations to reproduce (or predict) the results.

In his presented papers No.103 and No.108, he described his hypothesis and math-physical models to guesstimate the pancreatic beta cells health state by using a data range including FPG (lower

bound), pre-periods glucose (medium), and PPG baseline glucose (upper bound). In this paper, he will utilize the "*annualized* average FPG" over a 6-year period (2014 - 2019) and to prove the probable partial recovery of insulin regeneration functions either through converting alpha cells into beta cells (as the quoted article) or self-repairing some of damaged beta cells (as author's own hypothesis).

## Results

In his previous research results, he has demonstrated the high correlation between FPG and weight (78%), as shown in Figure 1. In the annualized FPG vs. Weight, the correlation rate is even higher (93%). Although body weight strongly links with FPG, it also influences FPG's level. Nevertheless, the focus here is to study the FPG value change's trend and pattern. Figure 2 shows the changes of his *annualized average FPG* and *annualized weight* with a correlation of 86%. His FPG started in 2014 at 128 mg/dL and ended in 2019 at 113 mg/dL with a decrease of 15 mg/dL (11.7% of 128 mg/dL). In Figure 2, his annualized FPG values continue to drop every year except during 2017 (weight rising similar to FPG rising in 2017).

As shown in Figure 3, on average, his FPG value decreases at a linear speed of 2.3% per year during this six year period which is closely related to the above quoted article result that 2% of alpha cells "reprogram" themselves and start producing insulin (without knowing their timing period). This reduction of FPG value could be interpreted as the major factor and the direct outcome of the pancreatic beta cells partial self-recovery of insulin generation capability.

There is a possible but legitimate concern about the FPG data validity. Therefore, the author used ~6,000 Sensor FPG data in 548 days (5/5/2018 - 11/3/2019) to compare with the 548 Finger FPG data within the same period. He used the Finger FPG against both Sensor average FPG and Sensor FPG near Finger PPG's measurement time in early morning, specifically. As shown in Figure 4, the maximum deviation between them is ~2 mg/dL (2.4%). However, his Sensor data period is still not long enough to be used in this beta cells study since it requires a longer period of time to onset and maintain the probable "self-recovery" process of partial pancreatic beta cells. At least, the Sensor data can provide some data validity proof to this research work.

## Conclusions

The author observed improvement in his diabetes conditions after following a stringent lifestyle management in 2014. From examining his own glucose data in 2018 including the existing vulnerable conditions of his "damaged" beta cells due to his high carbs/sugar intake, he hypothesized that beta cells are still able to "repair" themselves to a certain degree. This "dual-phenomena" can be observed with his ultra-high PPG values when he violated his own strict control rules of diet and exercise during the same period of pancreatic beta cells partial recovery [1-4].

The author decided to work off his research and write this article to encourage other medical scientists to conduct similar work, even though they may use different methods, to further explore this subject of "probable pancreatic beta cell's self- recovery".

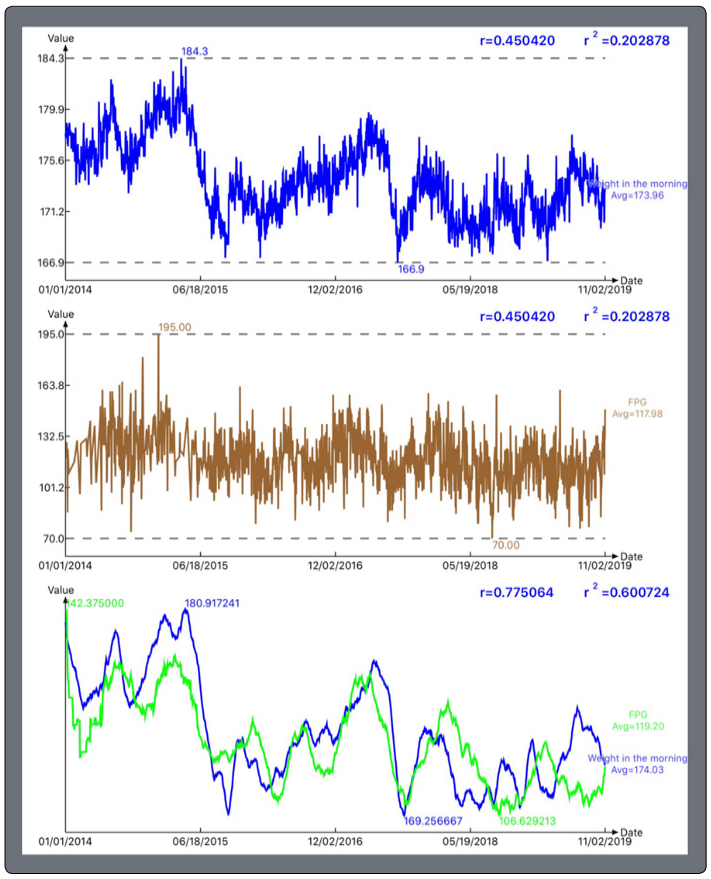


**Figure 1:** Daily FPG and Weight (1/1/2014 - 11/2/2019)

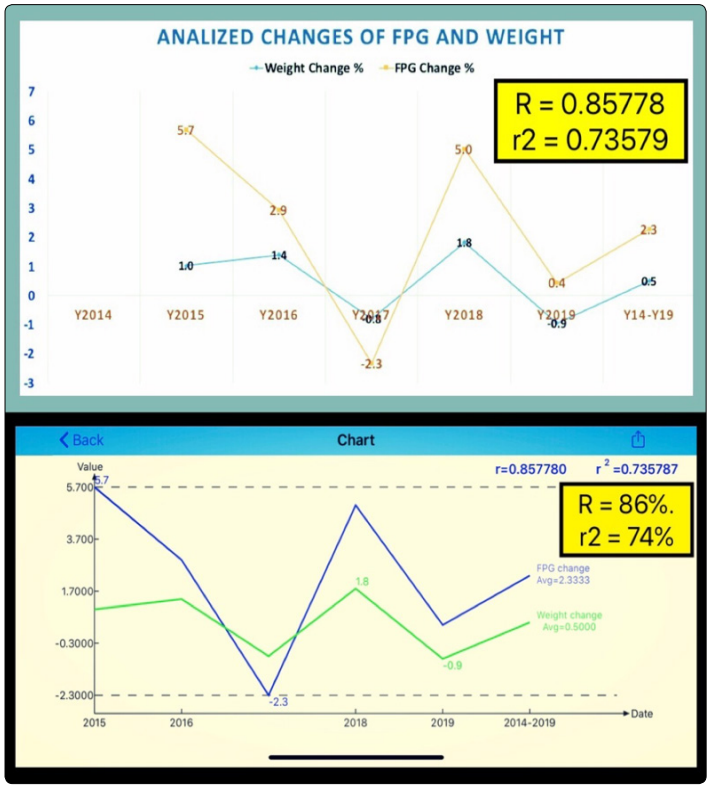


**Figure 2:** Annualized average FPG and Weight (2014 - 2019)

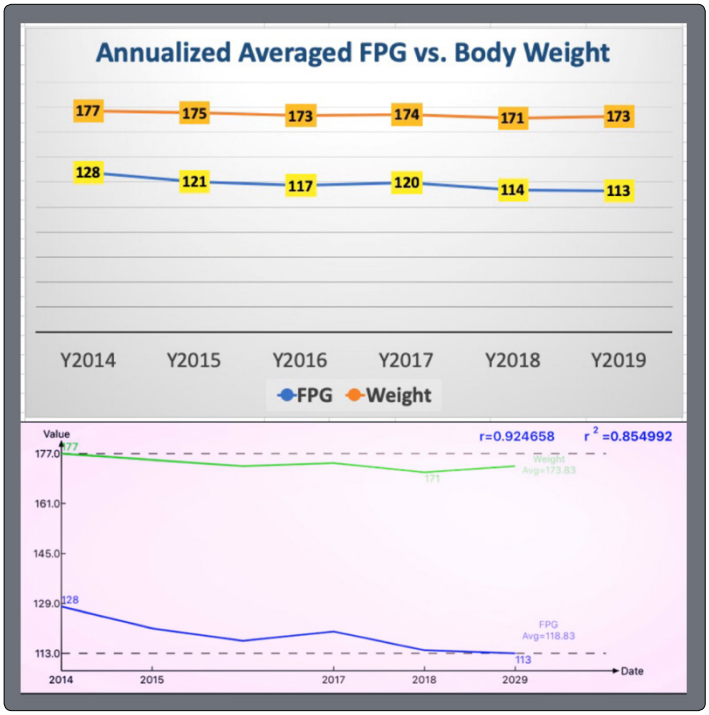


**Figure 3:** Annualized change % of average FPG and Weight (annualized 2015 to 2019 plus change per year between 2014 and 2019)

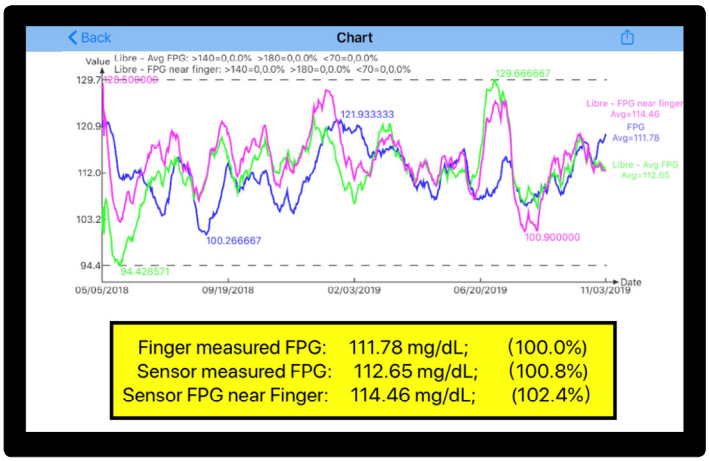


**Figure 4:** FPG data validation (Finger FPG & Sensor FPG 5/5/2018 - 11/3/2019)

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