
Gerald C Hsu*

eclaireMD Foundation, USA

*Corresponding Author: Gerald C Hsu, eclaireMD Foundation, USA.

Received: October 09, 2020; Published: October 22, 2020

Abstract

The author utilizes quantitative analysis results based on diabetes control for two periods, pre-COVID-19, from 5/5/2018 to 1/18/2020, and COVID-19, from 1/19/2020 - 8/25/2020, with a duration of 2.3 years. Special attention has been placed on applying the American Diabetes Association (ADA) 2020 Guidelines for TIR%, TAR% and TBR% to study their differences between two time periods.

Based on the chart above, two conclusions can be drawn. First, his TIR% occupies 70%-95% of his total glucose data during the pre-COVID-19 and 82% - 98% of his total glucose data during COVID-19. Second, his average daily glucose values within TIR are 118 - 127 mg/dL for pre-COVID-19 and 112 - 118 mg/dL for COVID-19. These two facts prove that his diabetes conditions are well-controlled; however, his performance during the COVID-19 period is even better than the prior timeframe.

The COVID-19 virus is the worst epidemic in recent human history in terms of its spreading speed, fatality number, and emotional impact on the world population. People belonging to the “vulnerable” groups, such as the elderly with history of or existing chronic diseases and complications, require special consideration to their health conditions as well as lifestyle management program during this period. However, the author has achieved even better results on his diabetes control in terms of FPG, PPG, daily glucose and HbA1C values. The knowledge and experience he has acquired in the past 10 years of medical research and his developed mathematical metabolism index model and four diabetes prediction tools have assisted him in many ways. More importantly, the quiet, stable, and undisturbed lifestyle during this timeframe does contribute to his better glucose control situation. As a result, he has achieved an overall lower glucose values and a lower HbA1C value prior to the pre-COVID-19 period. In fact, he turned the COVID-19 crisis into his health advantage!

Keywords: American Diabetes Association (ADA); Glucose Analyses; Pre-COVID-19; COVID-19; GH-Method
Introduction

The author utilizes quantitative analysis results based on diabetes control for two periods, pre-COVID-19, from 5/5/2018 to 1/18/2020 and COVID-19, from 1/19/2020 - 8/25/2020, with a duration of 2.3 years. Special attention has been placed on applying the American Diabetes Association (ADA) 2020 Guidelines for TIR%, TAR%, and TBR% to study their differences between two time periods.

Methods

Background

To learn more about the GH-Method: math-physical medicine (MPM) methodology, readers can review the article to understand his MPM analysis method [1], along with the outlined history of his personalized diabetes research and application tools development [2].

During 2015 and 2016, he dedicated his time to research four prediction models related to his diabetes measurement conditions, i.e. weight, postprandial plasma glucose (PPG), fasting plasma glucose (FPG), and HbA1C (A1C). As a result from using his developed mathematical metabolism model and four prediction tools, by end of 2016, his weight was reduced from 220 lbs. (100 kg) to 176 lbs. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), averaged finger glucose from 280 mg/dL to 120 mg/dL, and 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 had achieved excellent results on all fronts, especially glucose control. However, during 2018 and 2019 (overlapping the pre-COVID-19 period), he traveled to 50+ international cities to attend 60+ medical conferences and made ~120 oral presentations. The hectic schedule inflicted damage to his diabetes control, through dinning out along with exercise disruption, and on the overall metabolism status due to irregular life routines through traveling.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checked his glucose measurements every 15 minutes, a total of ~96 times each day. He has maintained the same measurement pattern since 5/5/2018 until present day.

ADA TIR% guidelines

Recently, the ADA published revised guidelines regarding CGM collected data which included three newly recommended measurement guidelines: (1) TIR: time-in-range 70 - 180 mg/dL for “acceptable” diabetes glucose range; (2) TAR: time-above-range > 180 mg/dL for severe diabetes concerns and (3) TBR: time-below-range < 70 mg/dL as a warning for insulin shock [3,4].

Although the author has already made noticeable improvements on his diabetes control, he wanted to do better. Therefore, he established another set of guidelines for his more stringent glucose control by replacing the 180 mg/dL cut-offline with a lower 140 mg/dL for both TIR and TAR. In this particular study, he combined the "ADA standards" with his "Customized standards" into a hybrid, but slightly more complicated with five segments as standards to depict his glucose segmentation analysis results.

After the ADA’s announcement, several research papers have been written regarding this subject [5-7]. Some minor data differences exist in the studies between reference 5 and 6; however, those research papers are based on collected CGM data belonging to diabetes patients. Lacking clear evidence, the author would like to make a logical assumption that “most” of those tested data collected from patients were taking medications.
Candlestick K-line model

Around 1850, a Japanese merchant, who traded in the rice market in Osaka, Japan, started the "candlestick charting". An American, Steve Nison brought the candlestick concept to the Western world in 1991. These techniques are currently used in the stock market by financial analysts to predict the trend of stock prices and/or aid with the required action for the investment.

On 4/17/2018, the author had an idea to study glucose behavior by using the candlestick chart as known as the "K-Line" and subsequently developed a customized software to analyze his big data of glucoses. These candlesticks not only provide five key characters of each daily glucoses but also reveal the average values and trends over a period of time when combined with the time-series analysis [8,9].

Results and Discussion

The author applies the following three standards for his glucose (mg/dL) segmentation calculations:

- Customized standards (3): TIR: 70-140; TAR: >140, TBR: < 70.
- Hybrid standards (5):
  - TIR: 70 - 180 and 70 - 140
  - TAR: > 140 and > 180
  - TBR: < 70.

Glucose percentage and average glucose in mg/dL in each range are shown using the ADA and Own standards for the "pre-COVID-19 period" (Figure 1). Figure 2 glucose percentage and average glucose in mg/dL in each range are depicted using both ADA and Customized standards for "COVID-19" (Figure 2).

Figure 1: Pre-virus period (5/5/2018 - 1/18/2020).
It would be difficult to determine the summarized information from these big data analytics graphic results as demonstrated in figure 1 and 2. Therefore, he highlights their summarized data in figure 3.

Figure 2: Virus period (1/19/2020 - 8/26/2020).

The combined bar charts of glucose percentages are illustrated in the top diagram and the average glucose values in mg/dL are displayed in the bottom diagram for the periods of pre-COVID-19 and COVID-19 (Figure 4). This is the most important and conclusive chart for this article.

Figure 3: Background data table.

Figure 4: TIR, TAR, TBR % and average glucose mg/dL between two periods.
There are five noticeable findings listed below during the pre-COVID-19 and COVID-19 periods:

1. His TIR% are 0% in pre-COVID-19 and 1% in COVID-19. This means that he has an exceptionally low risk on having an “insulin shock”.

2. His ADA standard’s TAR% (>180) are 5% in pre-COVID-19 and 1% in COVID-19. Although both of them are low, he has a much lower risk of 1% for COVID-19 than the low risk of 5% for pre-COVID-19 in regard to “hyperglycemia”. However, his Customized standard’s TAR% (> 140) are 30% for pre-COVID-19 and 18% for COVID-19. Even though these TAR percentages are at moderate levels, the COVID-19 of 18% has a lower level than the pre-COVID-19 of 30%.

3. The existence with his occasional glucose levels of being greater than 180 mg/dL or below 70 mg/dL have proven that he is indeed a “type 2 diabetes patient” regardless of his diabetes conditions being well-controlled since 2017.

4. His ADA standard’s TIR% (70 - 180) are 95% for pre-COVID-19 and 98% for COVID-19. In addition, his Customized standard’s TIR% (70 - 140) are 70% for pre-COVID-19 and 82% for COVID-19. Both of the ADA and Customized standards’ TIR% occupy the majority of his collected big glucose data. These fact proves that his diabetes conditions have been well-controlled during the pre-COVID-19 and COVID-19 periods. However, the performance in COVID-19 period is even better than the pre-COVID-19 period.

5. The average glucose values in each range can be observed in the bottom diagram of figure 4. The most significant numbers are the average TIR glucose values. His ADA standard’s TIR (70 - 180) average glucose values are 127 mg/dL in pre-COVID-19 and 118 mg/dL during COVID-19. His Customized standard’s TIR (70 - 140) are 118 mg/dL in pre-COVID-19 and 112 mg/dL during COVID-19. These values prove that his T2D conditions have been well-controlled, but they are better in the COVID-19 period than the pre-COVID-19 period with differences of -9 mg/dL for ADA standards and -6 mg/dL for Customized standards.

Here are the key influential factors of the following 6 detailed lifestyle items, regarding glucose formation, that have kept the author’s glucoses within a healthy level without medications:

1. Carbs/sugar amount: The difference of 2.4 grams would contribute about 4 to 5 mg/dL on finger PPG difference. This is mainly due to his home cooled meals without dining out during this period. He also maintained high-quality protein with nutritional balanced diet.

2. Exercise: This factor can be ignored since he sustained an almost equal level of post-meal walking steps during these two periods (4,284 steps for pre-COVID-19 vs. 4,290 steps for COVID-19). His daily walking steps are approximately 16,000 steps.

3. Ambient weather temperature: This factor can also be disregarded since both periods cover colder temperature in winter and warmer temperature in summer. The average ambient weather temperatures are 74° Fahrenheit for pre-COVID-19 period and 71° Fahrenheit for COVID-19 period.

4. No traveling and jet lag during this timeframe.

5. Stress-free life during this timeframe by focusing on his medical research work and avoiding the emotional disturbance from news associated with current politics and COVID-19 fatalities.
6. Sleep: He has maintained 7 to 8 hours of good quality sleep every night.

In figure 5, it shows five specific key characters developed from the “K-Line model” of synthesized daily PPG candlesticks. Since PPG is the most substantial components of his daily average glucose, by comparing the open (0-minute), close (180-minutes), minimum PPG, maximum PPG, and average PPG for the pre-COVID-19 period and COVID-19 period, the findings also confirmed that the values during COVID-19 are lower than the pre-COVID-19 period.

![Figure 5: Key characters of K-Line glucose data (synthesized daily candlesticks).](image)

**Conclusion**

The COVID-19 virus is the worst epidemic in recent human history in terms of its spreading speed, fatality number, and emotional impact on the world population. People belonging to the “vulnerable” groups, such as the elderly with history of or existing chronic diseases and complications, require special consideration to their health conditions as well as lifestyle management program during this period. However, the author has achieved even better results on his diabetes control in terms of FPG, PPG, daily glucose, and HbA1C values. The knowledge and experience he has acquired in the past 10 years of medical research and his developed mathematical metabolism index model and four diabetes prediction tools have assisted him in many ways. More importantly, the quiet, stable, and undisturbed lifestyle during this timeframe does contribute to his better glucose control situation. As a result, he has achieved an overall lower glucose values and a lower HbA1C value prior to the pre-COVID-19 period. In fact, he turned the COVID-19 crisis into his health advantage!

**Bibliography**


**Volume 5 Issue 11 November 2020**
© All rights reserved by Gerald C Hsu.

---