

Research Article

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Diabetes Control and Metabolism Maintenance During Covid-19 Period in Comparison to Three Other Periods Using GH-Method: Math-Physical Medicine

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ABSTRACT

This paper describes the author's quantitative results of diabetes control and metabolism maintenance within a 4.5-year period covering two years from 7/1/2018 to 6/30/2020. Special attention has been placed on the COVID-19 quarantine period from 1/1/2020 to 6/30/2020.

COVID-19 is more than 100 times worse than SARS that occurred in 2003, 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 existing chronic diseases and history of complications, or people with psychological disorders, who require special attention to their health conditions and lifestyle management during this quarantine period. However, during this time, the author has achieved better results on both of his diabetes control and metabolism management. The knowledge and experience he has acquired in the past 10 years of medical research and his developed MI model and diabetes prediction tools have assisted him in many ways. As a result, he has turned the COVID-19 crisis into his health advantage!

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Introduction

This paper describes the author's quantitative results of diabetes control and metabolism maintenance within 4.5-years covering a period of two years from 7/1/2018 to 6/30/2020. Special attention has been placed on the COVID-19 quarantine period from 1/1/2020 to 6/30/2020.

Methods**Background**

The author spent ~30,000 hours over the past 10 years, from 2010 to 2020, to conduct his research on chronic diseases and complications, along with endocrinology, specifically focusing on metabolism and glucose.

In the beginning, from 2010 to 2013, he self-studied internal medicine and food nutrition. He specifically focused on six chronic diseases, i.e. obesity, diabetes, hypertension, hyperlipidemia, cardiovascular disease (CVD) & stroke, and chronic kidney disease (CKD). In 2014, he allotted the entire year to develop a complex mathematical metabolism model which includes 4 body output categories (weight, glucose, blood pressure, lipids) and 6 body input categories (food, water, exercise, sleep, stress, daily life routine regularity). There are about 500 detailed elements included in these 10 categories. By the end of 2014, he has finally developed a mathematical metabolism model embedded in a specially designed application software ("eclaireMD") on the iPhone for his daily use in order to maintain his health status.

During the development process, he has defined two more new variables, metabolism index (MI) and general health status unit (GHSU), where GHSU is the 90-days moving average MI that is similar to the relationship between HbA1C and 90-days moving average glucoses. The analysis results of this dynamic model can be expressed through these two overall health variables, MI and GHSU, to describe a person's health status and also identify shortcomings in any specific health area at any moment in time.

In the following two-year period, 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 own developed metabolism model and 4 prediction tools, his weight 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 remarkable accomplishments is that he no longer takes any diabetes medications since 12/8/2015.

During 2018 and 2019, he traveled to 50+ international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to both of his diabetes control, through eating outside along with exercise disruption, and overall metabolism status due to irregular life routines through traveling.

The author eluded the 2003 SARS threat in China and Taiwan. In early January of 2020, when the strange “Wuhan pneumonia” rumors suddenly appeared on certain Asian news networks, he immediately recognized the danger associated with this newly found virus. The spread of this disease depends mainly on the physical contact among people. Therefore, he started his “self-quarantine” in the United States on 1/19/2020, much earlier than the majority of Europeans and Americans who became aware of its potential damage and severity. As of today, 7/4/2020, he has been self-quarantined for 5+ months or 167 days. This time frame’s regular life pattern with home cooked meals and consistent walking exercise have made his conditions of diabetes control (from his glucose results) and overall metabolism (from his MI results) reach to its “best” status for the past 25 years.

Data Collection

Since 1/1/2012, the author measured his glucose values using the finger-piercing method: once for FPG and three times for PPG each day. On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device (Freestyle Libre) on his upper arm and checked his glucose measurements every 15 minutes, a total of ~80 times each day. After the first bite of his meal, he measured his postprandial plasma glucose (PPG) level every 15 minutes for a total of 3-hours or 180 minutes. He has maintained the same measurement pattern during all of his waking hours. However, during his sleeping hours (00:00-07:00), he measured his fasting plasma glucose (FPG) in one-hour intervals.

Epidemic Information

COVID-19 is a disease caused by SARS-CoV-2 virus which uses ACE-2 for cell entry [1]. The current thought is that the disease is spread through respiratory droplets, though the transmission is still under investigation. Also, the virus has been found in blood and stool. Figure 1 shows that COVID-19 is a spectrum of diseases. Approximately 80% of confirmed cases are uncomplicated SARS-CoV-2 infection which may lead to mild pneumonia. About 15% would lead into severe pneumonia, with the remaining 5% ending up as acute respiratory distress syndrome (ARDS).

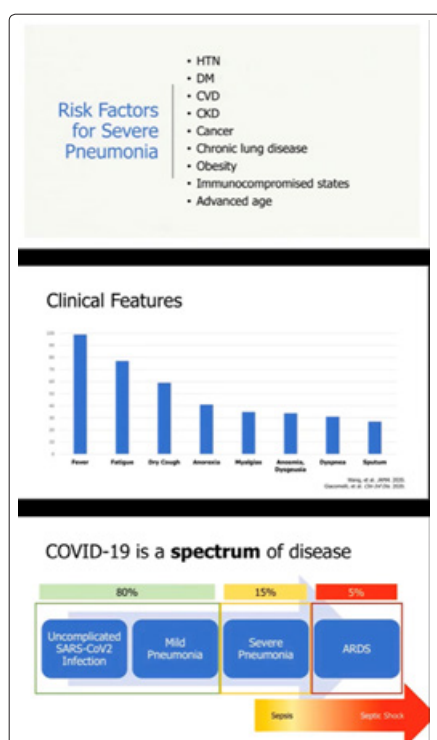


Figure 1: COVID-19 information (Reference 1)

Figure 2 depicts confirmed cases and number of deaths in the USA since its inception until now, 7/4/2020. This figure contains both curves in real scale and logarithm scale. It is obviously that, COVID-19 is still not under control in the US; therefore, the author has mentally prepared that he will remain in his existing self-quarantined life until the end of 2020.

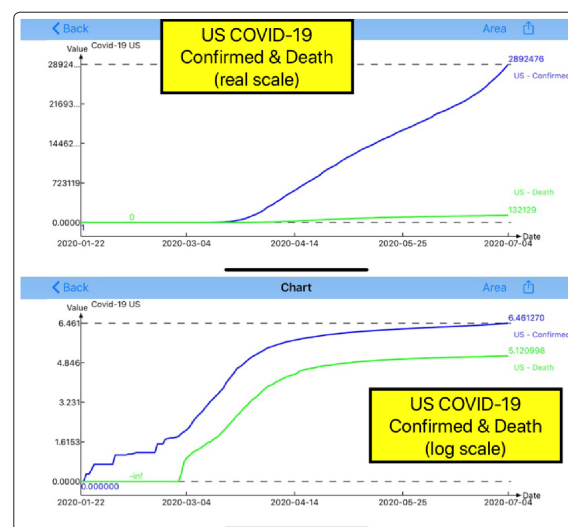


Figure 2: COVID-19 history and status in USA (7/4/2020)

Chronic diseases and Health

“Linkage among metabolism, immune system, and various diseases using GH-Method: math-physical medicine (MPM)”, the most effective defensive protection against COVID-19 is our immune system [2]. Furthermore, our immune system is closely related to our overall metabolic conditions. We can safely say that metabolism and immunity are two sides of one coin. In order to strengthen our overall metabolism, we must manage our daily lifestyle to build up a strong and firm foundation over a long period of time for overall health (Figure 3).

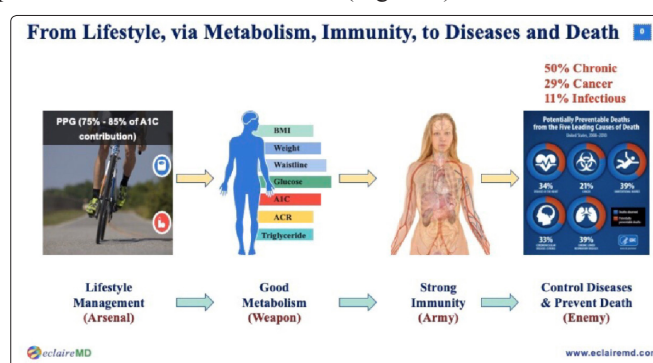


Figure 3: Relationships among Lifestyle, Metabolism, Immunity, and Diseases

In short, lifestyle is similar to the product quality and production capacity of an arsenal based on the overall educational, technological, and industrial power, whereas metabolism is similar to the effectiveness and destruction power of the weapons available to soldiers which are produced by an arsenal. Immunity is similar to the overall military strength of the armed forces (assembly of soldiers with weapons), while diseases (chronic, cancer, and infectious) are similar to an enemy’s invasion force. Lastly, the study of death is similar to the investigation of outcomes of a war, which is the probability and rate of death [3].

Results

The author's research specialty is in the area of metabolic disorders. In this article, he will summarize the knowledge and experiences gained regarding his diabetes control and metabolism improvement over the last two years, especially during the COVID-19 period.

The bold italic statements in following paragraphs indicate the COVID-19 period.

Figure 4 lists his lab-tested HbA1C results during the last two years from 7/1/2018 to 6/30/2020. Figures 5, 6, and 7 illustrate the detailed curves of his daily data of finger glucose, sensor glucose, and MI values. Figure 8 shows the bar chart comparison of the four biomedical values during the four different time periods.

eclairMD Data			
A1C History			
Date	Lab	eclairMD	Adjusted
06/20/2020	6.4	6.32	6.33
12/20/2019	6.6	6.62	6.73
09/25/2019	6.6	6.52	6.55
07/11/2019	6.7	6.69	6.68
04/04/2019	6.8	6.81	6.84
02/13/2019	6.7	6.74	6.78
02/12/2019	6.7	6.74	6.79
01/18/2019	7.0	6.72	6.76
10/22/2018	6.6	6.82	6.74
06/29/2018	6.5	6.71	6.68
05/29/2018	6.8	6.71	6.73
01/26/2018	6.9	6.99	7.12
12/20/2017	6.8	6.79	6.89

Figure 4: Lab-tested HbA1C results (7/1/2018 - 6/30/2020)

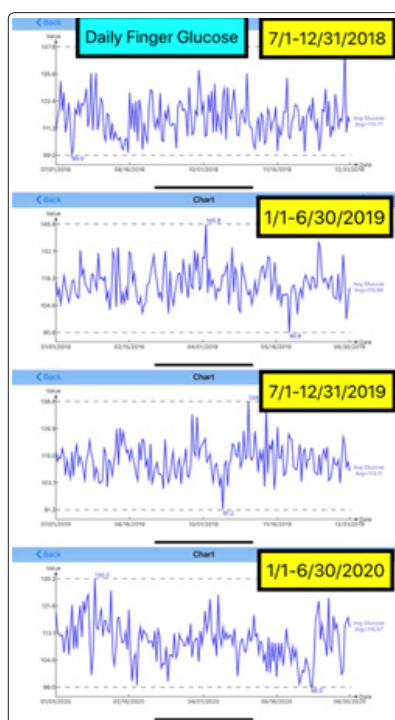


Figure 5: Finger-piercing glucose results (7/1/2018 - 6/30/2020)



Figure 6: Sensor-collected glucose results (7/1/2018 - 6/30/2020)

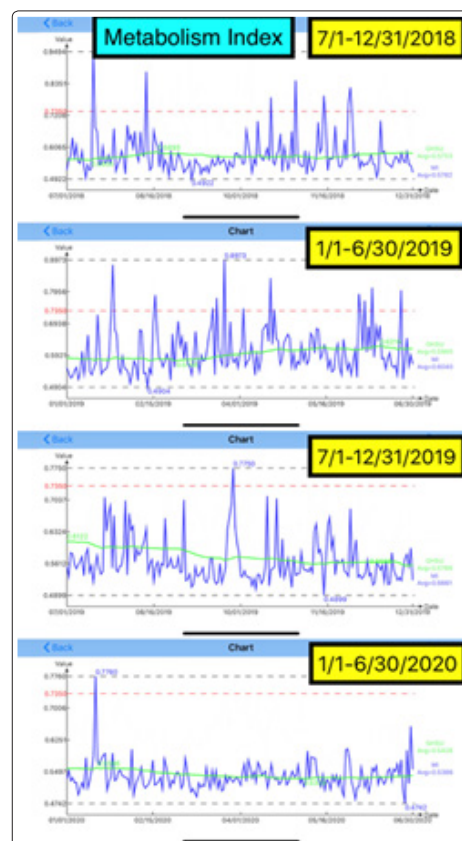


Figure 7: Metabolism Index (7/1/2018-6/30/2020)

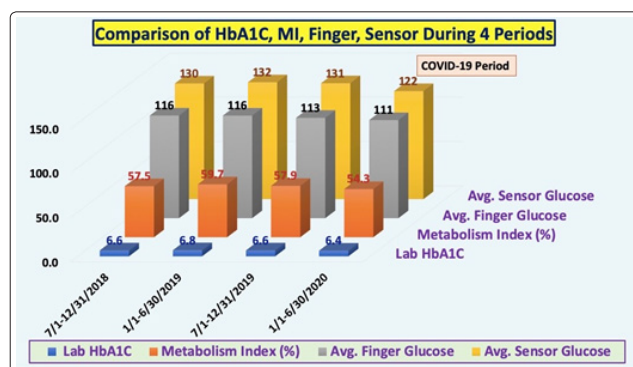


Figure 8: Bar chart of summarized results of this study (7/1/2018-6/30/2020)

It is obviously that the COVID-19 period, from 1/1/2020 to 6/30/2020, has the best performance scores on both diabetes control and metabolism conditions.

The following list depicts the actual values of these four periods in the order of HbA1C %, MI score, finger glucose value, and sensor glucose value.

Period A (7/1/2018 - 12/31/2018):

6.6%, 57.5, 116 mg/dL, 130 mg/dL

Period B (1/1/2019 - 6/30/2019):

6.8%, 59.7, 116 mg/dL, 132 mg/dL

Period C (7/1/2019 - 12/31/2019):

6.6%, 57.9, 113 mg/dL, 131 mg/dL

Period D (1/1/2020 - 6/30/2020):

6.4%, 54.3, 111 mg/dL, 122 mg/dL

It should be re-emphasized that all of the above diabetes data are not under any influences of medications.

There are three conclusive observations from the above list and in Figure 8. First, the COVID-19 period has shown the best performance records. Second, the obvious impact on both of his glucoses and MI resulted from his 2017-2018 traveling life which include stress, sleep disruption, exercise, and disturbance on his daily life routines, along with frequently eating out, can be seen via those elevated values. Third, his average sensor data of 129 mg/dL is approximately 13% higher than his average finger data of 114 mg/dL. The author has difficulty to know what is his “exact” glucose level, since both of the finger glucose and sensor glucose devices provide different levels of data accuracy due to the inherent device problems of reliability.

Conclusions

COVID-19 is more than 100 times worse than SARS that occurred in 2003, 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 existing chronic diseases and history of complications, or people with psychological disorders, who require special attention to their health conditions and lifestyle management during this quarantine period. However, during this time, the author has achieved better results on both of his diabetes control and metabolism management. The knowledge and experience he has acquired in the past 10 years of medical research and his developed MI model and diabetes prediction tools have assisted him in many ways. As a result, he has turned the COVID-19 crisis into his health advantage!

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