

## The Change in Health Biomarkers for Bodyweight and Glucoses Between the Pre-Virus Period and COVID-19 Period Based on GH-Method: Math-Physical Medicine (No. 468)

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Submitted: 24 Nov 2021; Accepted: 30 Nov 2021; Published: 07 Dec 2021

**Citation:** Gerald C Hsu (2021) The change in health biomarkers for bodyweight and glucoses between the pre-virus period and COVID-19 period based on GH-Method: math-physical medicine (No. 468). J Clin Exp Immunol, 6(6): 404-408.

### Abstract

This paper describes the author's quantitative improvements on his weight and glucose resulting from lifestyle modifications. Special attention has been placed on both the pre-virus period from 5/5/2018 to 1/18/2020 (total 624 days with 1,934 meals and snacks) and the COVID-19 quarantined period from 1/19/2020 to 6/16/2021 (total 514 days with 1,536 meals).

This article emphasizes on bodyweight, glucoses, and glucose fluctuations (GF) during the two compared periods.

In general, his health conditions of weight and glucoses in the COVID-19 period (514 days) are better than his health conditions in the pre-virus period (624 days).

The COVID-19 pandemic 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, require special attention to their health conditions and lifestyle management during this COVID-19 quarantine period. In this particular period, the author achieved better results on both his diabetes control and overall metabolism management. The knowledge and experience he has gained in the past 11 years of medical research and his developed metabolism index (MI) model along with his four diabetes prediction tools assisted him in many ways. During the quarantine period, he has stopped traveling and suffered no jet-lag, eating home-cooked meals, maintaining nutritional balance, continuing his daily walking exercise of 16,000 steps (~10.7 km or 6.7 miles each day), sleeping 7.2 hours each night, living a stress-free life, avoiding negative news of politics and the pandemic, and keeping a regular daily life routine.

The author enjoys conducting medical research, which is his obsessive hobby, and does not need to make a living off his work. Therefore, he feels no pressure at all to continuously perform research over the past 11 years. As a result, he has actually turned the COVID-19 crisis into his health advantage!

### Introduction

This paper describes the author's quantitative improvements on his weight and glucose resulting from lifestyle modifications. Special attention has been placed on both the pre-virus period from 5/5/2018 to 1/18/2020 (total 624 days with 1,934 meals and snacks) and the COVID-19 quarantined period from 1/19/2020 to 6/16/2021 (total 514 days with 1,536 meals).

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fluctuations (GF) during the two compared periods.

### Methods

Background Information: The author spent ~30,000 hours over the past 11 years, from 2010 to 2021, 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, obesity, diabetes, hypertension, hyperlipidemia, cardiovascular disease (CVD) & stroke, and chronic kidney disease (CKD). In 2014, he allotted the entire year and used topology concept of mathematics with modeling technique of finite element method of mechanical and structural engineering to develop a complex mathematical metabolism index (MI) model. This MI model includes 4 body outputs, i.e., symptoms which include weight for obesity, glucose for diabetes, blood pressure for hypertension, and lipids for hyperlipidemia; and 6 body inputs, i.e., causes, stressors or stimulators which include food portion and nutritional balance, water intake (for blood dilution, circulation and detoxification), regular and persistent exercise, high quality sleep, stress reduction, daily life routine regularity. Not only do they have a strong connection between these 6 inputs and 4 outputs, but they also have a complicated inter-relationship within these two groups of outputs and inputs. Furthermore, the author also defined about 500 detailed elements within these 10 categories. Theoretically, the total number of inter-relationships among these 500 elements is 500! (500 factors). This is an unnecessary obstacle with a nearly impossible task. In summary, he decided to use a series of linearized mathematical operations to describe this highly nonlinear and dynamic bio-medical system. In addition, he can calculate a “static” snapshot to peek into this complex and dynamic metabolism system. By the end of 2014, he has finally developed a practical, yet accurate enough mathematical metabolism model embedded in a specially designed application software (eclairMD) on his 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 “ever-changing” 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. For example, at any time instant of a day, particularly when he has some changes or new inputs into his system, he can immediately see his “static snapshots” of health through his MI and GHSU values on his iPhone screen.

In the following two-year period of 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 four prediction tools, his obvious biomarker improvements between 2010 and 2021 are described below. His weight is reduced from 220 lbs. (100 kg) with BMI 32.5 to 169 lbs. (77 kg) with BMI 24.9; his waistline from 44 inches (112 cm) to 33 inches (84 cm), his average finger glucose from 280 mg/dL to 108 mg/dL, and HbA1C from 10% to ~6.2%.

Another remarkable accomplishment is that he no longer takes any diabetes medications since 12/8/2015. Thus far, he has lived a life of “free from chemical compounds” for 5.5 years.

During the pre-virus period from 2018 to 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 out often along with exercise disruption, sleep disturbance, increased stress, and overall metabolism disturbance due to his irregular life routines through his two-years of traveling period.

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, 6/17/2021, he has been self-quarantined for ~17 months or 514 days. This timeframe’s regular life pattern with 100% home-cooked meals (without eating snacks) and persistent walking exercise of ~16,000 steps each day have made his medical and lifestyle conditions of diabetes control (from his glucose values) and overall metabolism (from his MI scores) reach to its “best” status over 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 on his upper arm and checked his glucose measurements every 15 minutes, a total of ~96 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.

Math-physical methodology: The author is a mathematician, physicist, computer scientist, professional engineer, and an experienced entrepreneur. However, he lacks the academic training in both areas of biology and chemistry; therefore, he cannot conduct his medical research utilizing the “traditional biochemical medicine” approach. This was the reason he has utilized his past acquired knowledge and experience to study and research his diabetes conditions and its various complications during the past 11 years. In 2010, three medical physicians warned him about the severity of his diabetes and diabetic complications, including heart attacks and kidney failure that reached a life-threatening stage. Out of desperation, he shut down all of his business activities and moved to a desert city to launch his self-study and research of his multiple chronic diseases in order to save his own life.

The description below explains what is the “GH-Method: math-physical medicine” (MPM) research methodology developed by the author for his biomedical research.

Any system, whether political, economic, engineering, biological, chemical, and even psychological have causes or triggers (inputs) and consequences or symptoms (outputs). There are definitely some existing connections between inputs and outputs that can be either simple or complicated. The inputs and outputs of any type of system, whether psychological, biological or chemical, can

be observed visually or measured by certain instruments. These physically observed phenomena, including features, images, incidents, graphs, or numbers, are merely the “physical expression” of these underneath system structure (e.g., human organs stand for biomedical system or human brain stands for mental state). Once we collect these physical phenomena or symptom readings, either examination report, incident, image, or data, we should be able to re-organize or categorize them in a logical manner. When we check or analyze the physical phenomena output and cannot figure out why they act or behave a certain way, we can formulate some guesses or hypotheses based on some basic principles, theories, or concepts from physics. At this point, we just cannot pull out an equation from a physics textbook and insert them into it like conducting a “plug and play” game. An equation is an expression of a concept or a theory, which is usually associated with some existing conditions, either initial condition or boundary condition. On the contrary, the biomedical or psychological system usually has a different kind of conditions from other systems. After understanding the meaning of observed physical phenomena, the next step is to prove the hypothesis, guess, or interpretation of the

phenomenon being correct or incorrect. A solid understanding of mathematics becomes extremely useful to develop a meaningful model which could represent the observed physical phenomena and created hypothesis. Various engineering modeling techniques and certain computer science tools, such as artificial intelligence, or big data analytics can offer great assistance on verification of analysis results from these mathematical operations. If the mathematical results cannot support the hypothesis, then a new hypothesis needs to be formulated. If this hypothesis is proven to be correct, then we can extend or convert this hypothesis into an equation or a simpler formula for others to adopt this easier way of thinking and analyzed results. In the final stage, the mathematical equation or formula will be able to “predict” future outcomes based on different sets of inputs.

### Results

There are 6 figures in this article that compares the author’s biomarkers between the pre-virus period and the COVID-19 period [1-3].

Pre-virus: 1934 meals; carbs=14.6g; walking=4284 steps; finger PPG=116			COVID-19: 1536 meals; carbs=13.3g; walking=4476 steps; finger PPG=108		
1		Libre glucose	1		Libre glucose
2	Avg	135.95	2	Avg	120.23
3	First-Bite	129.14	3	First-Bite	120.09
4	15 min	132.56	4	15 min	121.76
5	30 min	138.88	5	30 min	125.29
6	45 min	143.99	6	45 min	127.54
7	60 min	145.07	7	60 min	126.19
8	75 min	142.44	8	75 min	123.05
9	90 min	138.84	9	90 min	120.42
10	105 min	135.70	10	105 min	118.01
11	120 min	133.14	11	120 min	115.91
12	135 min	132.49	12	135 min	115.11
13	150 min	131.66	13	150 min	115.54
14	165 min	132.24	14	165 min	116.61
15	180 min	131.15	15	180 min	117.48

Figure 1: shows a tabular comparison of 2 synthesized PPG data.

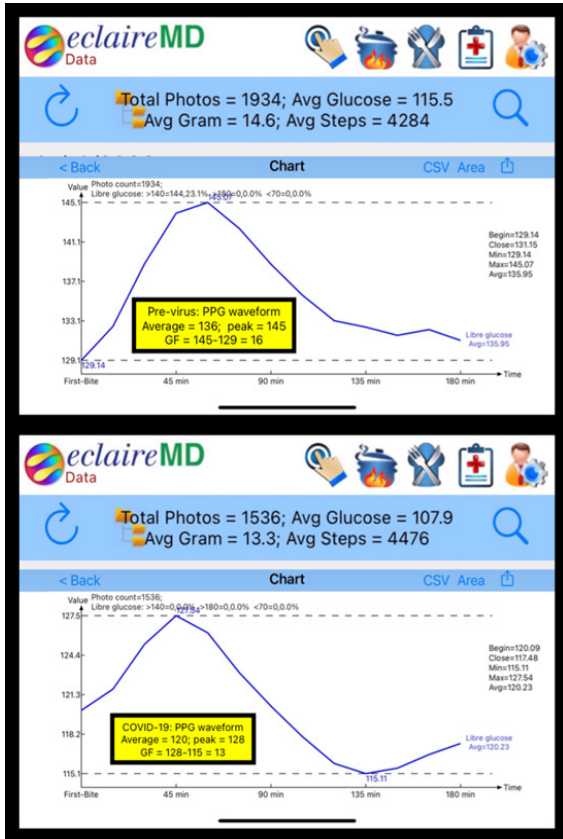


Figure 2: demonstrates 2 synthesized 3-hour duration of PPG waveforms.

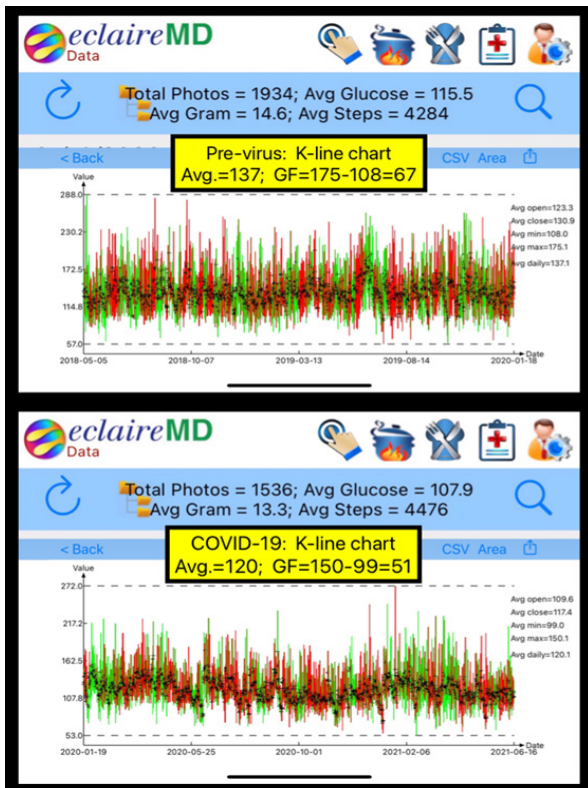


Figure 3: validates 2 candlestick K-line charts of the daily PPG

candlestick K-line charts within the specific time period.

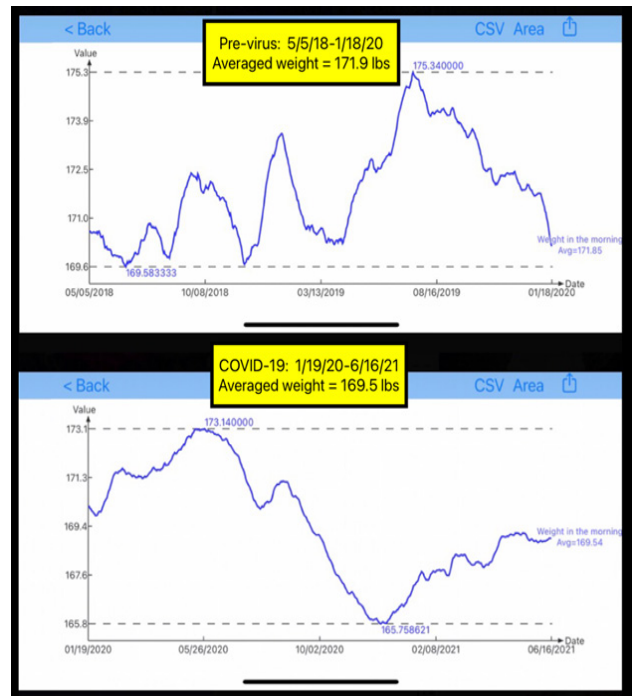


Figure 4: Daily body weight comparison

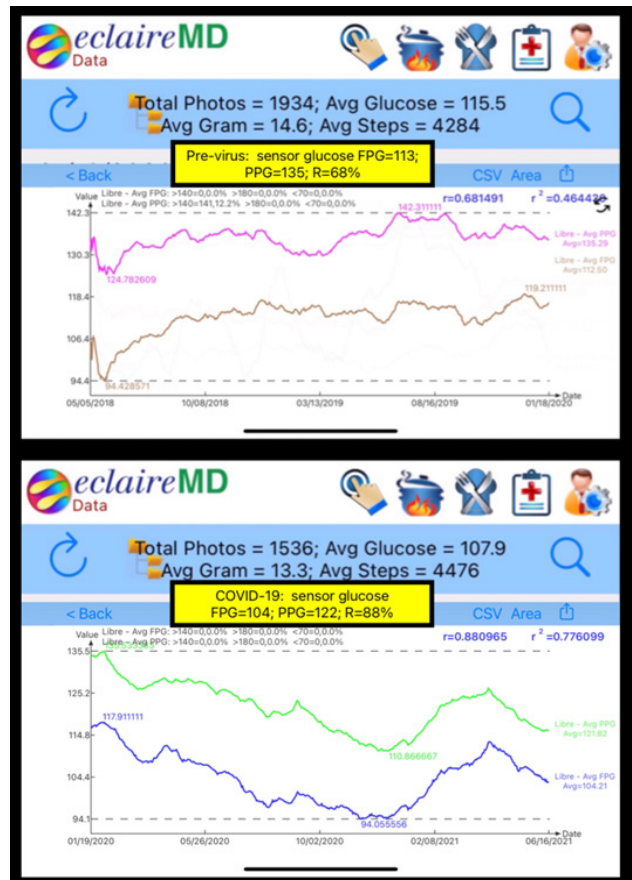
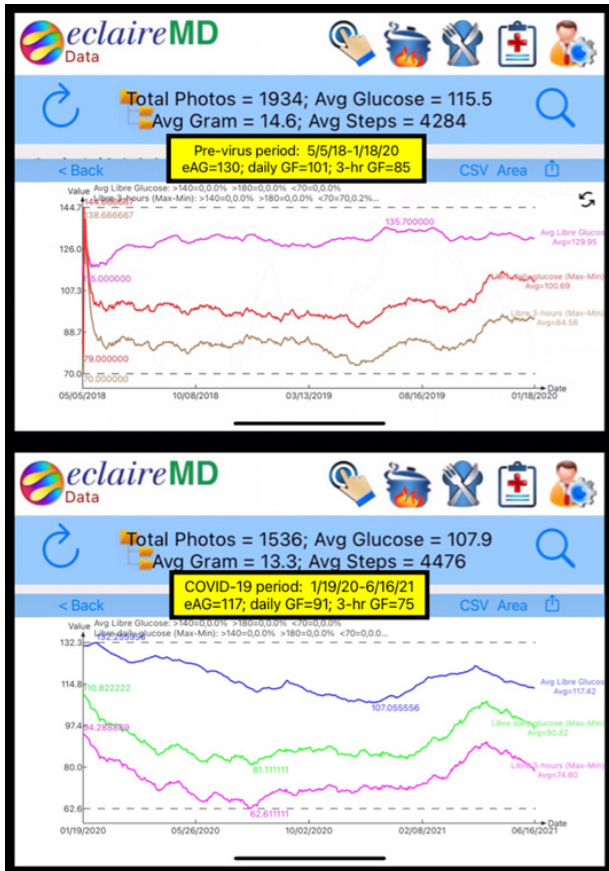


Figure 5: Daily sensor FPG and sensor PPG comparison



**Figure 6:** Daily sensor eAG, 24-hour GF, and 3-hour GF comparison

The following data table lists the summary comparison between the two periods in the format of pre-virus and COVID-19.

PPG waveform, Average: 136, 120  
 PPG waveform, Peak: 145, 128  
 PPG waveform, GF: 16, 13  
 PPG K-line, Average: 137, 120  
 PPG K-line, daily GF: 67, 51  
 Body weight, Average: 172, 170  
 Sensor FPG, Average: 113, 104  
 Sensor PPG, Average: 135, 122  
 Sensor daily eAG: 130, 117  
 Sensor daily GF: 101, 91  
 Sensor 3-hours GF: 85, 75

From the table above, it is evident that *all of the biomarkers have*

*demonstrated universally that the COVID-19 period is better and healthier compared to the pre-virus period.*

## Conclusions

In general, his health conditions of weight and glucoses in the COVID-19 period (514 days) are better than his health conditions in the pre-virus period (624 days).

The COVID-19 pandemic 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, require special attention to their health conditions and lifestyle management during this COVID-19 quarantine period. In this particular period, the author achieved better results on both his diabetes control and overall metabolism management. The knowledge and experience he has gained in the past 11 years of medical research and his developed metabolism index (MI) model along with his four diabetes prediction tools assisted him in many ways. During the quarantine period, he has stopped traveling and suffered no jet-lag, eating home-cooked meals, maintaining nutritional balance, continuing his daily walking exercise of 16,000 steps (~10.7 km or 6.7 miles each day), sleeping 7.2 hours each night, living a stress-free life, avoiding negative news of politics and the pandemic, and keeping a regular daily life routine.

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