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# A Comparison of Two Clinical Cases of Quantitative Lifestyles Medicine Using GH-Method: Math-Physical Medicine (No. 302)

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**ABSTRACT**

This article is a comparison of clinical cases of quantitative lifestyles medicine which is based on the data of two type 2 diabetes (T2D) patients during a period of 149 days from 3/1/2020 to 7/27/2020. The research methodology utilizes the author developed GH-Method: math-physical medicine (MPM) which has been applied for the past decade.

This study contains a comparison and interpretation of the following two T2D patients.

**Case A:** male, 47-years-old, 5 years of T2D history, with no signs of diabetes complications, BMI 40, and not taking any diabetes medication.

**Case B (author):** male, 73-years-old, 25 years of T2D history, with many diabetes complications except stroke, BMI 25, and not taking any diabetes medication for the past 5 years.

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In summary, based on average glucose values, Case A is classified in the "pre-diabetes" category, whereas Case B is classified in the "no diabetes" category. However, both of their peak daily glucoses occasionally reach above 160 mg/dL, which indicates that they are Type 2 Diabetes (T2D) patients. The main reason for the higher glucoses for Case A is due to inactivity and lack of post-meal exercise which could not burn off the energy generated via his carbs/sugar intake. On the other hand, for Case B, due to the stringent lifestyle management of reduced carbs/sugar intake of ~13 grams and average post-meal walking of ~4,300 steps, he has successfully reduced his average glucose from 280 mg/dL (HbA1C greater than 10%) in 2010 down to 117 mg/dL (HbA1C ~6.3%) in 2020. It should be emphasized that both patients are not taking any diabetes medications during this period.

In general, patients would get bloodwork done in a lab with the test results transmitted to the medical doctor for review. After examining the numbers on the lab reports, if required, the doctor would prescribe medication(s) to patients.

Unlike standard medical care, the author applies his math-physical medicine approach by using the patient's lifestyle big data and related graphic charts to determine the severity of the diabetes conditions, the shortfalls of the problem areas, and providing suggestions on how to improve the diabetes conditions via lifestyle modifications. Not only can this approach diagnose a patient's medical conditions and problems, it can focus on the needed areas of improvement with quantitative suggestions. The author calls this "Lifestyle Medicine". The approach directly works on the fundamental core issues of the diabetes medical conditions instead of depending on chemical compounds to suppress the symptoms which allow the disease's continual inner damage.

These two clinical cases of lifestyle medicine clearly demonstrate some evidence of practical use. By reading this research note, one can grasp the basic ideas and approach of the author's medical research work from the past decade.

## Introduction

This article is a comparison of clinical cases of quantitative lifestyles medicine which is based on the data of two type 2 diabetes (T2D) patients during a period of 149 days from 3/1/2020 to 7/27/2020. The research methodology utilizes the author developed GH-Method: math-physical medicine (MPM) which has been applied for the past decade.

## Method

GH-method: Math-Physical Medicine (MPM) Methodology

The description below explains the MPM research methodology developed by the author utilized in his biomedical research.

Any system whether medical, political, economic, engineering, biological, chemical, and even psychological have causes or triggers (inputs) and consequences (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, including biomedical system, can be observed visually, or measured by certain instruments. These physically observed phenomena, including features, images, incidents, or numbers are merely the partial "physical expression" of these underneath system structure. This system structure includes human organs for a biomedical system, the human brain for a neurological or mental system, or steel plate for structural or mechanical engineering system.

Once we have collected these readings of the physical phenomena (external expression, similar to a behavior, symptom, or response), through either incident, image, or data, we should be able to organize or categorize them in a logical manner. When we check or analyze these partial physical phenomena outputs and cannot figure out why they act or behave in certain way due to internal causes, reasons, or stressors, we can try to develop some guesses or formulate some hypotheses based on some available basic principles, theories, or concepts from physics. At this point, we just cannot pull out an existing equation from a physics textbook and insert these input variables in to conduct 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 or boundary; however, a biomedical system usually has 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. At this stage, a solid understanding of mathematics becomes extremely useful to develop a meaningful model which could represent or interpret these observed physical phenomena and created hypothesis. In addition, some engineering modeling techniques, such as finite element method and computer science tools, including software, artificial intelligence (AI), and big data analytics can offer great assistance on verification of analysis results from these mathematical operations.

If the mathematical results cannot support the created hypothesis, then a new hypothesis needs to be formulated. When this new hypothesis is proven to be correct, then we can extend or convert this hypothesis into a useful mathematical equation or into a simpler formula for others to adopt this easier way of thinking and understanding of the results. In the final stage, the derived mathematical equation or arithmetical formula can then be used to "predict" future outcomes of the selected system based on other different sets of inputs.

**Diabetes Research**

The author has spent the past 10-years to self-study and research metabolism, endocrinology, and diabetes. He spent his first four years, from 2010 to 2013, to self-study 6 chronic diseases, i.e. obesity, diabetes, hypertension, hyperlipidemia, cardiovascular diseases, stroke, as well as food nutrition. Food is probably the most important and also complicated input element to influence these 6 chronic diseases. After his first 4-years of self-reading and learning, he then spent the entire year of 2014 to develop a complicated model of metabolism. This mathematical model contains 4 biomarkers of medical conditions (weight, glucose, blood pressure, and lipids) along with 6 lifestyle details (food portion and nutritional balance, water intake, exercise, sleep amount and quality, stress reduction, and daily life routines regularity).

Starting from 2015, he spent three consecutive years, from 2015 to 2017, to discover the characteristics and behaviors of this complex "wild beast" of glucose. His major objective is to truly understand the "inner characteristics" of the glucose, not just using medication's chemical power to control its "external biological symptoms". His research work is similar to a horseman trying to tame a horse by understanding its temperament first, not just giving a tranquilizer to create a calm and quiet horse. As a result, during this period of 3 years, he has developed 4 prediction models, which include Weight, postprandial plasma glucose (PPG), fasting plasma glucose (FPG), and HbA1C with very high prediction accuracy to reach to his purpose of understanding glucoses.

The author estimated and proved that PPG contributes approximately 75% to 80% towards HbA1C formation. Therefore, he tried to unravel the mystery of PPG first. Through his diabetes research, he has identified at least 19 influential factors associated with PPG formation. Among those influential factors, diet (carbs/sugar amount) would provide ~38% and exercise (walking) would contribute ~41%. Combining these two primary influential factors, it gives ~80% of the PPG formation. Among the rest of the 17 secondary factors, the hot weather temperature contributes ~5%, stress and illness only make noticeable contributions when they occur.

For most T2D patients who take medications, its biochemical effect would become the most significant influential factor. However, as we know, medication cannot cure diabetes and only control its symptoms. Therefore, the author decided to focus on controlling diabetes at the most fundamental level by investigating its root cause. Previously, he has taken high doses of three prescribed diabetes medications for 18 years since 1997; however, in 2013, he started to reduce the number of prescriptions and dosages of his daily medications. By 12/8/2015, he finally ceased taking any diabetes medications.

From 2016 to 2017, he discovered a solid connection between his FPG and his weight (>90% of correlation). In addition, similar to his PPG research, he also recognized that there are about 5 influential factors of FPG formation with weight alone contributing >85% and cold weather temperature influencing ~5%.

Since July 2019, he also launched a special investigation on the degree of damage to his pancreatic beta cells. During the past 12-months of research work, he noticed that both of his FPG and PPG have been decreased in the last 6 to 8 years at an annual rate of 2.3% to 3.2%. In other words, his pancreatic beta cells have been self-regenerating or self-repairing about 14% to 26% over these years. He then thought about FPG as being a good indicator on how healthy his pancreatic beta cells are since there are no food intake and exercise while sleeping. Besides, his weight has been maintained around 172 lbs and his body has been "medication-free" over the past 5-years. It makes sense that FPG carries a significant and clear message about the baseline status of his overall glucoses.

The detailed explanation of his glucose research work is provided because this comparison study is based on "glucoses".

**Glucose Data Collection**

During this investigation period, both T2D patients are utilizing continuous glucose monitoring device (CGM: Libre Freestyle), on their upper arms, with an additional Bluetooth data transmission electronic device on top of the CGM in order to collect their glucoses at 5-minute time intervals. Therefore, at a collection rate of 288 glucose data per day, each patient would collect 42,912 glucoses data over the 149 days. While no device is free of defects, the existing glucose measuring device has inherent reliability problems. The collected datasets of these two patients would contain different data numbers with some different degrees of deficiency.

**Results**
This study contains a comparison and interpretation of the following two T2D patients.

**Case A:** male, 47-years-old, 5 years of T2D history, with no signs of diabetes complications, BMI 40, and not taking any diabetes medication.

**Case B (author):** male, 73-years-old, 25 years of T2D history, with many diabetes complications except stroke, BMI 25, and not taking any diabetes medication for 5 years.

Figure 1 shows the comparison of their daily average glucose (summation of daily glucoses divided by total glucose numbers) on a time scale of 149 days. Case A has an average glucose of 125 mg/dL which belongs to the category of pre-diabetes and Case B has an average glucose of 117 mg/dL which belongs to the category of no diabetes. However, ten years ago in 2010, Case B's average daily glucose was 280 mg/dL.

In reality, Case A has a peak daily glucose of 168 mg/dL and Case B has a peak daily glucose of 162 mg/dL reveal that both of them are classified as diabetes patients.

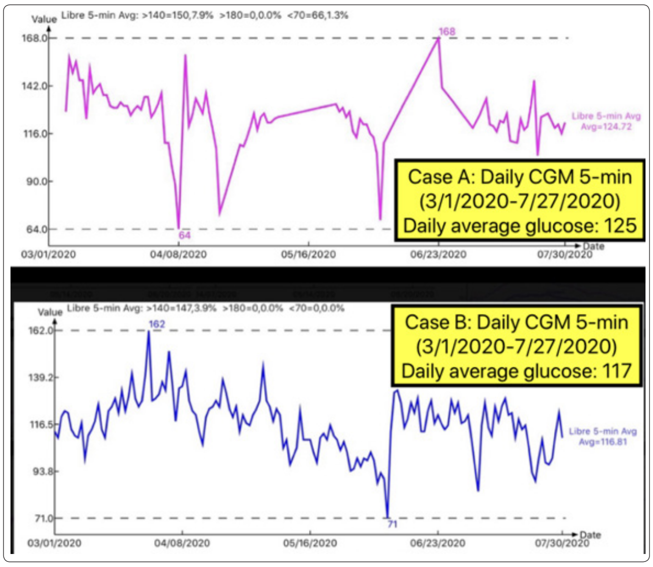


**Figure 1:** Daily CGM 5-minutes glucoses over 149 days (3/1/2020 - 7/27/2020)

Figure 2 reflects the comparison of their synthesized fasting plasma glucose (FPG) on a time scale of 7-hours (from 00:00 throughout 07:00). This figure is generated by averaging all of the 84 measured glucoses from midnight to 7 am over the 149 days. Both curve shapes (i.e. "waveforms") of Case A and Case B are the same "salad bowl" shape with the high ends on both edges (at 00:00 and 07:00) and the low end at the bottom of the bowl (at 04:00). The author developed his data analysis software to use the average glucoses of these 84 data from 7 hours to be the patient's "average FPG".

Case A has an average FPG of 121 mg/dL with his lowest FPG at 113 mg/dL. Case B has an average FPG of 103 mg/dL with his lowest FPG at 97 mg/dL. This FPG comparison discloses that both cases are on target with their FPG levels, but Case B is better than Case A. It should be noted that in 2010, Case B's average FPG was ~200 mg/dL.

Normally, the FPG level indicates the relative health state of pancreatic beta cells due to FPG data collecting period contains no influences from food and exercise. On top of the influential factors, both patients are not taking any diabetes medication. The author focuses on the lowest FPG due to his concerns of having "insulin shock".

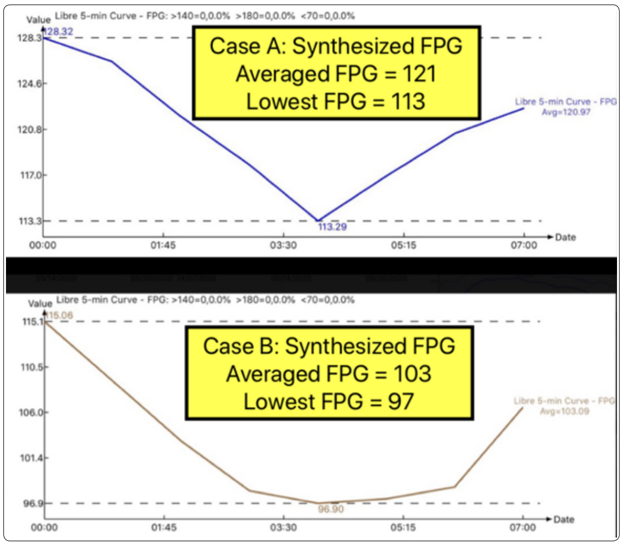


**Figure 2:** Synthesized CGM 5-minutes FPG over 149 days (3/1/2020 - 7/27/2020)

Figure 3 depicts the comparison of their synthesized PPG on a mealtime scale of 3-hours from the first bite at 0 minute to 180 minutes. This figure is generated by averaging all of the 36 measured glucoses for 3 meals per day over these 149 days. The author developed his data analysis software to use the average glucoses of these 36 data within 3 meal hours to be the patient's "average PPG".

Each patient had different first bite times for the 3 meals as follows:

**Case A**
Breakfast 08:00, Lunch 13:30, and Dinner 18:00

**Case B**
Breakfast 07:00, Lunch 12:00, and Dinner 18:00

In Figure 3, these two PPG wave forms (i.e. curve shapes) are vastly different. Case A is a shape of "Himalaya Mountain" while Case B is a shape of "Grand Canyon".

From the top diagram of Figure 3, Case A's PPG starts from 124 mg/dL at 0-minute and drops slightly to 122 mg/dL at 40 minutes, and then climbs up continuously to 132 mg/dL at 180 minutes (peak PPG), with an average PPG of 126 mg/dL. His PPG curve shape is similar to the Himalaya Mountain, i.e. "climbing up and stays at the top". This clearly indicates that Case A does not exercise at all and the internal energy generated from his carbs/sugar intake will not dissipate easily. This situation is similar to a car with a gasoline additive (carbs/sugar) and then allowing the car to run freely without applying the brake system (exercise).

On the other hand, from the bottom diagram of Figure 3, Case B's PPG starts from 124 mg/dL at 0-minute, and continuously climbs up to 133 mg/dL at 45 minutes (peak PPG), and then quickly drops down to 120 mg/dL at 140 minutes with an average PPG of 125 mg/dL. His PPG curve shape is similar to the Grand Canyon. This clearly indicates his PPG rising was due to his average carbs/sugar intake of 12.65 grams which would generate ~23 mg/dL

PPG amount. Around 45 minutes after his first bite of meal, he starts to do his routine post-meal walking exercise at 4,258 steps which would reduce ~21 mg/dL PPG amount. Therefore, the net gain of his PPG from his carbs/sugar intake and post-meal exercise would be a mere 2 mg/dL.

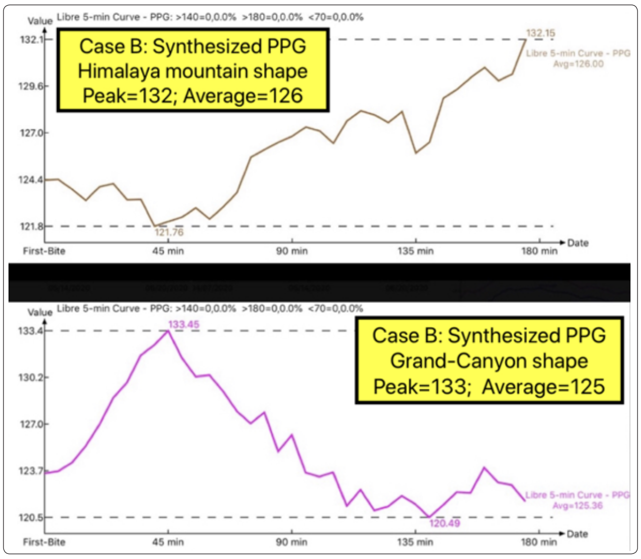


**Figure 3:** Synthesized CGM 5-minutes PPG over 149 days (3/1/2020 - 7/27/2020)

Theoretically, if Case B does not do his post-meal exercise, his PPG shape would also be a Himalaya Mountain shape with its peak around ~147 mg/dL and his average PPG at >140 mg/dL. Case B's situation is also similar to a car with a gasoline additive (carbs/sugar), and then allow the car to run for a while, then applying the brake system (exercise) to "burn off" its energy.

It should be noted that Case B's average PPG was ~300 mg/dL in 2010.

Finally, Figure 4 illustrates another synthesized daily glucoses curve over the entire day (24 hours with 288 glucose data-points). By comparing these two cases, their general curve shapes or waveforms are quite similar except Case A has a deeper glucose drop around 13:00 before the first-bite of his lunch at 13:30. Between 12:00 noon to 13:00, his energy input from breakfast has been burned off entirely. Both waveforms start with a salad bowel shape from 00:00 to 07:00, then followed by the first rising peak from breakfast, and the highest peak of the day from lunch, then followed by another lower peak from dinner, and finally drop down before bedtime. Case A's breakfast peak is not shown clearly due to his inactivity; therefore, his glucoses are continuously rising and then has a sharp drop before his lunch. His post lunch also connects with his dinner which has a similar pattern to his post-breakfast, again due to his inactivity after his meals.

From Figure 4, Case A has a daily average 125 mg/dL which is 7% higher than Case B daily average 118 mg/dL. This 7% difference is not significant, however, Case B is a severe T2D patient with 25- year history along with a daily average glucose that reached 280 mg/dL in 2010, while Case A got his diabetes only 5 years ago. This indicates the importance of post-meal exercise for Case A in order to avoid developing serious diabetes complications in his future years.

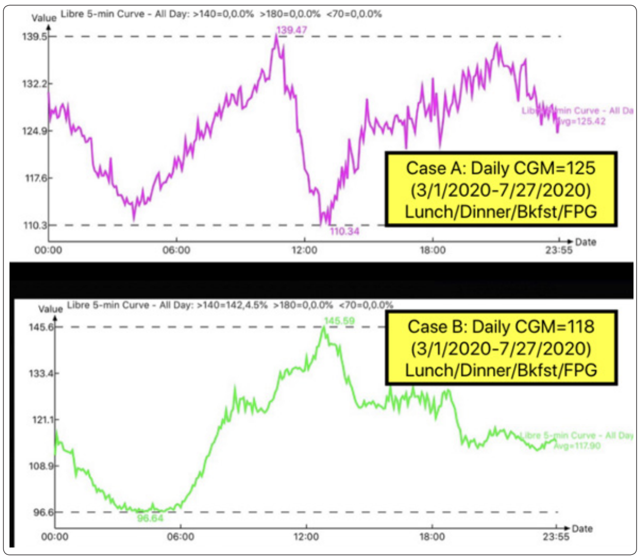


**Figure 4:** Synthesized CGM 5-minutes Daily Glucoses over 149 days (3/1/2020 - 7/27/2020)

In summary, based on average glucose values, Case A is classified in the "pre-diabetes" category, whereas Case B is classified in the "no diabetes" category. However, both of their peak daily glucoses occasionally reach above 160 mg/dL, which indicates that they are Type 2 Diabetes (T2D) patients. The main reason for the higher glucoses for Case A is due to inactivity and particularly, lack of post-meal exercise which could not burn off the energy generated via his carbs/sugar intake. On the other hand, for Case B, due to the stringent lifestyle management of reduced carbs/sugar intake of ~13 grams and average post-meal walking of ~4,300 steps, he has successfully reduced his average glucose from 280 mg/dL (HbA1C greater than 10%) in 2010 down to 118 mg/dL (HbA1C ~6.3%) in 2020. It should be mentioned that both patients are not taking any diabetes medications during this period.

**Conclusions**

In general, patients would get bloodwork done in a lab with the test results transmitted to the medical doctor for review. After examining the numbers on the lab reports, if required, the doctor would prescribe medication(s) to patients.

Unlike standard medical care, the author applies his math-physical medicine approach by using the patient's lifestyle big data and related graphic charts to determine the severity of the diabetes conditions, the shortfalls of the problem areas, and providing suggestions on how to improve the diabetes conditions via lifestyle modifications. Not only can this approach diagnose a patient's medical conditions and problems, it can focus on the needed areas of improvement with quantitative suggestions. The author calls this "Lifestyle Medicine". The approach directly works on the fundamental core issues of the diabetes medical conditions instead of depending on chemical compounds to suppress the symptoms which allow the disease's continual inner damage [1-4].

These two clinical cases of lifestyle medicine clearly demonstrate some evidence of practical use. By reading this research note, one can grasp the basic ideas and approach of the author's medical research work from the past decade.

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