

A Lifestyle Medicine Model for Family Medical Practices based on 9-Years of Clinical Data Including Food, Weight, Glucose, Carbs/Sugar, and Walking Using Linear Elastic Glucose Theory along with GH-Method: Math-Physical Medicine, Part 14 (No. 367)

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Abstract

This article is aimed at assisting family medical practices for obesity and type 2 diabetes (T2D) control using the lifestyle medicine model, which is Part 14 of his recently developed linear elastic glucose theory (LEGT).

More than 33 million Americans, about 1 in 10, have diabetes, and approximately 90% to 95% of them have T2D, where 86% also have problems with being overweight or obese. In other words, 7.7% to 8.2 % of the US population or 25 to 27 million Americans have issues with weight, T2D conditions, and multiple complications.

The author is a patient who suffered with being overweight/obese and T2D for over 25 years. He faced many complications from 2002 to 2010. Over the past 11 years, he dedicated himself to research diabetes and its complications. In this study, he describes the simple and straightforward yet highly precise method to control his chronic disease conditions, including weight and glucose. The results of his research provide proof through a big data analytics of his collected input data through the continuous research and implementation efforts over the past 9 years. His findings have finally achieved satisfactory health results with high mathematical precision on his various biomarker predictions.

He named this the “lifestyle medicine” approach. The purpose of writing this article is to offer a simple but practical approach to patients with chronic diseases like himself.

In summary, the author describes his straightforward implementation model in the following four steps:

1. By reducing his weight from 189 lb. to 170 lb. (-19 lb. or -10% in total weight), cutting off about 50% of his original over-eating food portion size (from 130% in 2012 down to 66% in 2020, which is -7% of his annual food portion reduction from original amount, or -6% average annual reduction continuously). This food portion reduction will automatically reduce the intake amount of fat and carbohydrates along with strictly controlling his sugar and sodium amounts, while maintaining a sufficient intake amount of high-quality protein.
2. When his weight dropped from 189 lbs. to 170 lbs. (-10% or -1.1% per year), his FPG then decreased from 140 mg/dL to 102 mg/dL (-38 mg/dL or -27%, or -3% per year) accordingly. Weight and FPG are highly correlated (93%).
3. When his FPG decreased, his PPG also reduced from 128 mg/dL to 108 mg/dL (-20 mg/dL or -16%, or -1.7% per year), providing he limits his carb/sugar intake amount below 15 grams per meal along with walking at least 30 minutes after each meal. He also increased his post-meal walking from 500 steps to 4,400 steps (+433 post-meal steps per year or +87% per year in comparison with his walking steps in 2012).
4. He wants to re-emphasize the importance of diet and exercise. Normally, reduction on food and meal portion will automatically assist in limiting the carbs/sugar intake amount. However, patients should always watch for the overall nutritional balance. For the author, his carbs/sugar intake amount has been cut down from 20 grams to 12.5 grams per meal (-7.5 grams or -38%, or -4% per year) because of his food portion reduction from 130% to 66% (-64% of food portion or -7% per year).

*This article merely provides a clinical proof using a quantitative and precision approach. These mathematical and biomedical accomplishments are based on careful physical phenomena observations, related biomedical interpretation, and proof process. This particular research project of food nutrition and biomedicine has utilized his developed GH-Method: math-physical medicine in which 366 medical papers have been published. The above four statements are simple to understand. Therefore, there is no need to learn fancy theories, complex formulas or equations. No need to take special seminars or attend college courses, take high dosages of medications or supplements, or go through any unnecessary surgeries. There are straight-line relationships existing among food, exercise, weight, and glucose that follow a simple and straight-line route of **from food portion control to weight reduction and arrive at glucose stability for both FPG and PPG.***

Introduction

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More than 33 million Americans, about 1 in 10, have diabetes, and approximately 90% to 95% of them have T2D, where 86% also have problems with being overweight or obese. In other words, 7.7% to 8.2 % of the US population or 25 to 27 million Americans have issues with weight, T2D conditions, and multiple complications.

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Methods

Background

To learn more about the author’s GH-Method: math-physical medicine (MPM) methodology, readers can refer to his article to understand his developed MPM analysis method in [1].

Case Description

The author has had T2D for over 25-years, while being obese and overweight. In 2010, his weight was 220 lbs. (BMI 32.5), with a daily average glucose over 200 mg/dL. He has also suffered many diabetes complications, including five cardiac episodes, severe kidney complications, foot ulcer, diabetic retinopathy, bladder infections, hypothyroidism, and others. After receiving warnings from three individual physicians regarding his serious conditions and death threats, he decided to self-study those chronic diseases and tried to make a serious change on his overall lifestyle.

After 9 years of his continuous efforts, over the past 6 months in 2020, his average weight is 169.5 lbs. (BMI 24.9) and his average daily glucose is 103 mg/dL (FPG 94, PPG 106) without taking any

medications or insulin injections.

Data Collection

Since 1/1/2012, the author developed a research-oriented software on his iPhone to collect all of his diabetes-related medical data and lifestyle details. He also spend the entire year of 2014 to develop a mathematical model of metabolism, which has been served as the cornerstone of his follow-up research work. He started to keep a complete daily record of his weight (morning and bedtime) since 4/11/2015, and his glucoses since 6/1/2015. Prior to mid-2015, he had sparse data that were not as complete compared to the period after mid-2015.

In addition, he started to collect his glucose data using a continuous glucose monitor (CGM) sensor device from 5/5/2018. He has accumulated approximately 91 glucose data per day with 13 glucose data per meal over a 3-hour time span. However, he discovered that his average sensor-collected glucoses is about 16% higher than his finger-pierced glucoses, where his postprandial plasma glucose (PPG) data are measured at 2-hours after the first bite of meal. They are usually located at the lowest position on his 3-hour long sensor PPG waveforms.

In order to keep the data consistency and data integrity of his analysis, he decided to use finger glucose values in this particular study since it covers a long time period of 9-years.

Mathematics of Data Processing

In this article, he mainly used average annual values from time-series domain and then conducted correlation coefficient calculations, in addition to pattern and trend analysis via observations of moving-average waveforms.

Other than utilizing the two GH-modules based on his recently developed linear elastic glucose theory (LEGT) to verify the existing relationships among weight, PPG, FPG, Carbs/sugar intake amount and post-meal walking k-steps, there are no other elaborate mathematical tools used in this analysis and article.

Factors Affect Body Weight

There are many factors that can affect body weight. Some of these key factors are:

- Age
- Gender
- Frequency and number of fasting
- Dietary fat vs. burning of body fat
- Exercise persistence
- Stress situations
- Sleep quality

- Calories influence on hormones
- Existing health conditions
- Thyroid conditions
- Insulin resistance
- Metabolic rate

Weight reduction or control is a complex issue and task. To benefit most patients, the author will skip the detailed academic discussions regarding the above-mentioned weight influential factors, concentrate on the discovery and identification of a simpler, and more straightforward route to accomplish the goal of weight control.

Results

Figure 1 shows three curves of weight, FPG, and PPG during the period of 2012 to 2020. Figure 2 depicts three curves of Food portion, Carbs/Sugar intake, and Post-meal Walking during the period of 2012 to 2020. In these two diagrams, all of the 5 curves trend downward year after year, except for the exercise curve of post-meal walking that trends upward.

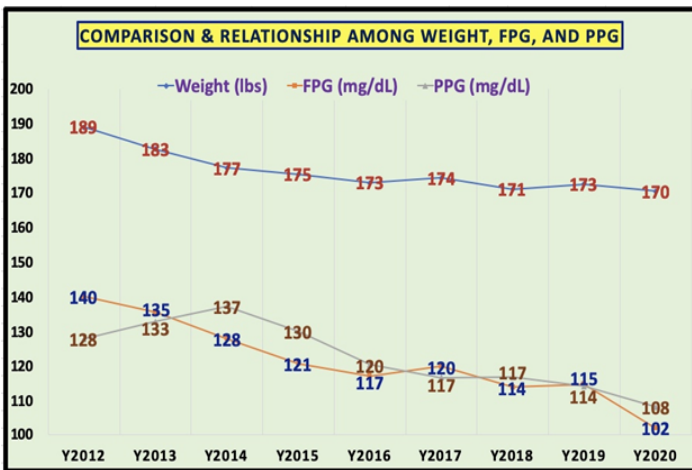


Figure 1: Comparison among Weight, FPG, and PPG

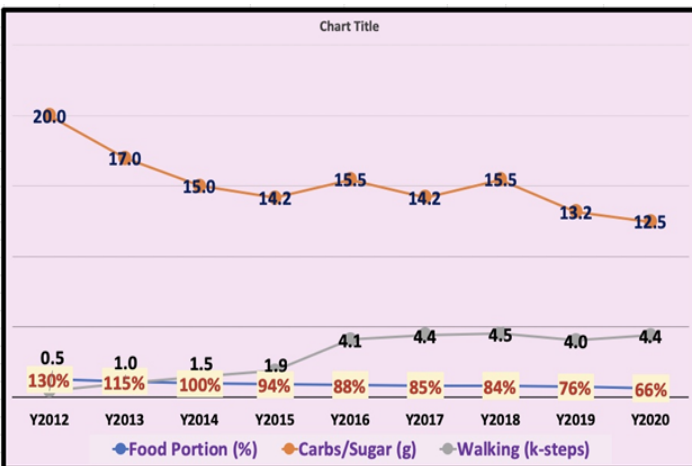


Figure 2: Comparison among Food portion, Carbs/Sugar intake, Post-meal Walking

Figures 3, 4, and 5 reveal correlation coefficients (R) of two curves in a pair since R can only be calculated between two curves (two sets of data). These three diagrams reflect a total of 9 pairs of results for R with a total of 6 variables: weight, FPG, PPG, food portion percentage, carbs/sugar amount, and post-meal walking k-steps. In statistics, any R greater than 50% means these two variables are closely inter-related with each other. Therefore, from these 9 sets of R percentages, only PPG vs. carbs/sugar has 53% R and weight vs. PPG has 65% (53% and 65% are already high enough), all other R values are greater than 70%. This proves that the 6 variables in this article are highly correlated with one another.

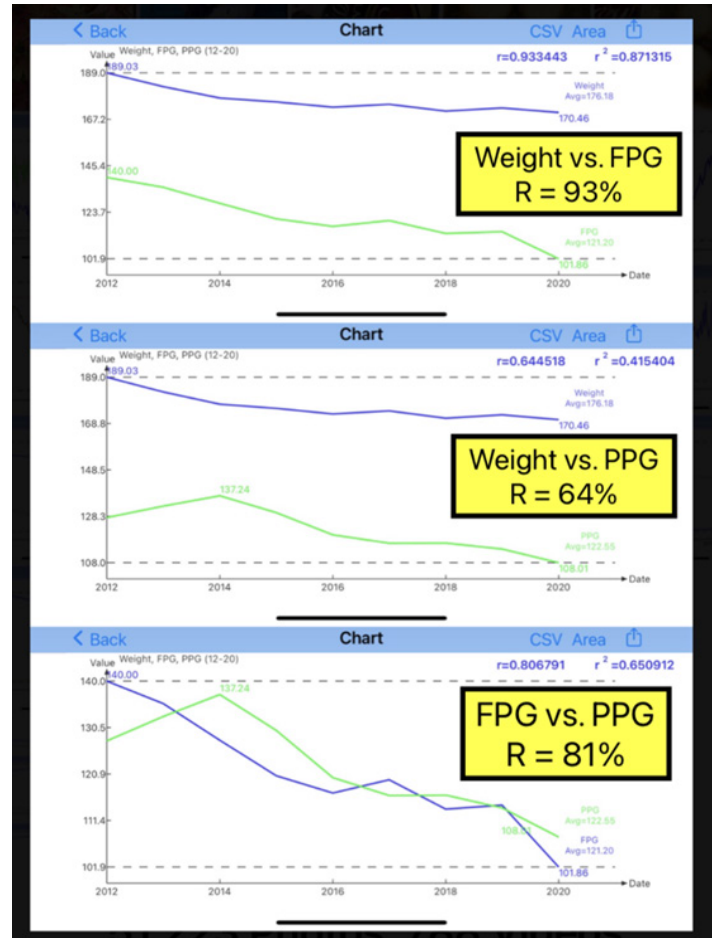


Figure 3: Three correlation coefficients (R) among Weight, FPG, and PPG

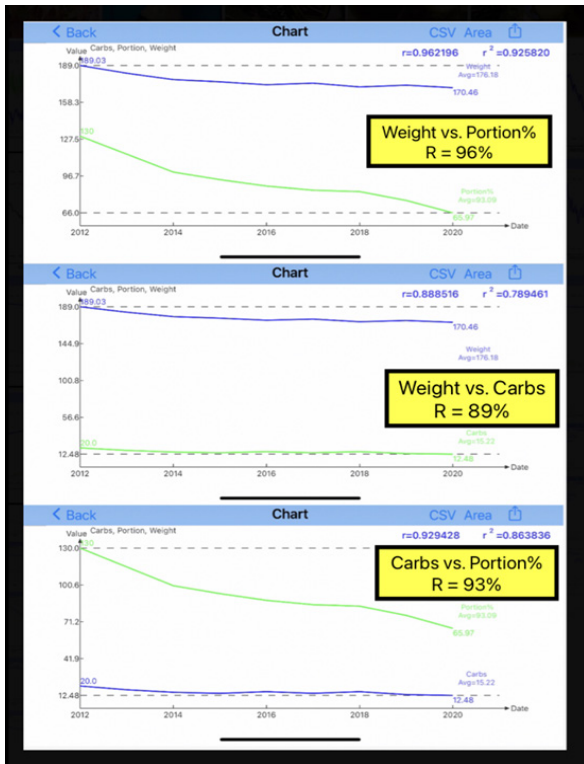


Figure 4: Three correlation (R) among Weight, Food portion, and Carbs/Sugar

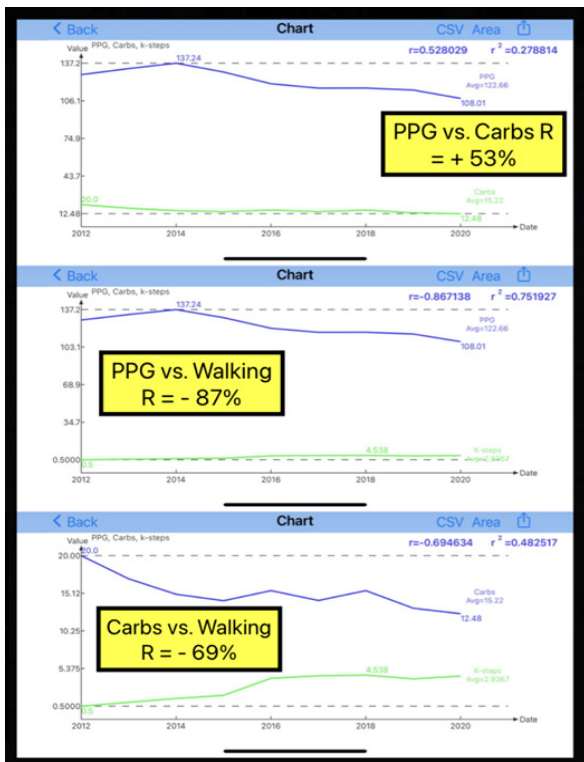


Figure 5: Three correlation coefficients (R) among PPG, Carbs/ Sugar, and Post-meal walking

Figure 6 summarizes 9 correlation coefficients into one table. By observing this table, readers will have a clear picture regarding the “tight relationships” among weight, glucoses (both FPG and PPG), food portion percentage, carbs/sugar intake amount, and post-meal walking steps.

Correlation Coefficient (R) between Biomarkers		
Weight vs. FPG	Weight vs. PPG	FPG vs. PPG
93.34%	64.45%	80.68%
Weight vs. Food	Weight vs. Carbs	Food vs. Carbs
96.22%	88.85%	92.94%
PPG vs. Carbs	PPG vs. Walking	Carbs vs. Walking
+52.80%	-86.71%	-69.46%

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Figure 6: Summary table of 9 correlation coefficients

Figure 7 recaps the annual reduction rates of weight, food portion, FPG, PPG, and carbs/sugar amount.

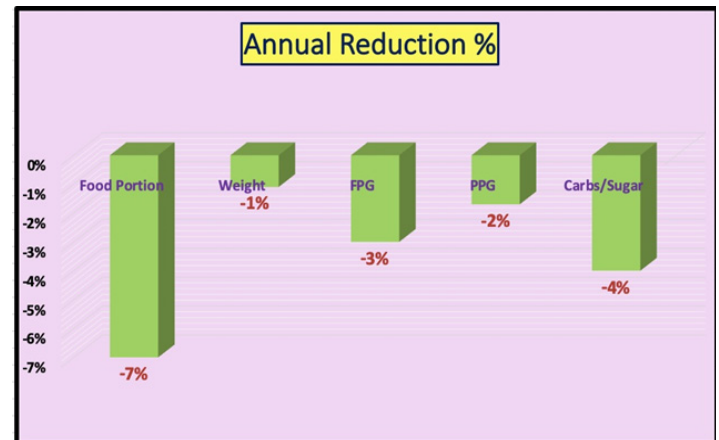


Figure 7: Annual reduction rates

Finally, Figure 8 displays all of the numerical numbers for data used in this analysis and report.

1/1/12	Height (inches)			
11/22/20	69.5			
	Weight (lbs)	FPG (mg/dL)	PPG (mg/dL)	BMI
Y2012	189	140	128	27.5
Y2013	183	135	133	26.6
Y2014	177	128	137	25.8
Y2015	175	121	130	25.5
Y2016	173	117	120	25.2
Y2017	174	120	117	25.4
Y2018	171	114	117	24.9
Y2019	173	115	114	25.1
Y2020	170	102	108	24.8
	Food Portion (%)	Carbs/Sugar (g)	Walking (k-steps)	Glucose (mg/dL)
Y2012	130%	20.0	0.5	131
Y2013	115%	17.0	1.0	133
Y2014	100%	15.0	1.5	135
Y2015	94%	14.2	1.9	128
Y2016	88%	15.5	4.1	119
Y2017	85%	14.2	4.4	117
Y2018	84%	15.5	4.5	116
Y2019	76%	13.2	4.0	114
Y2020	66%	12.5	4.4	106

Figure 8: Data table

Figure 9 shows the two calculated GH-modulus values based on the linear elastic glucose theory (LEGT). Here are the definitions of the two GH-modulus:

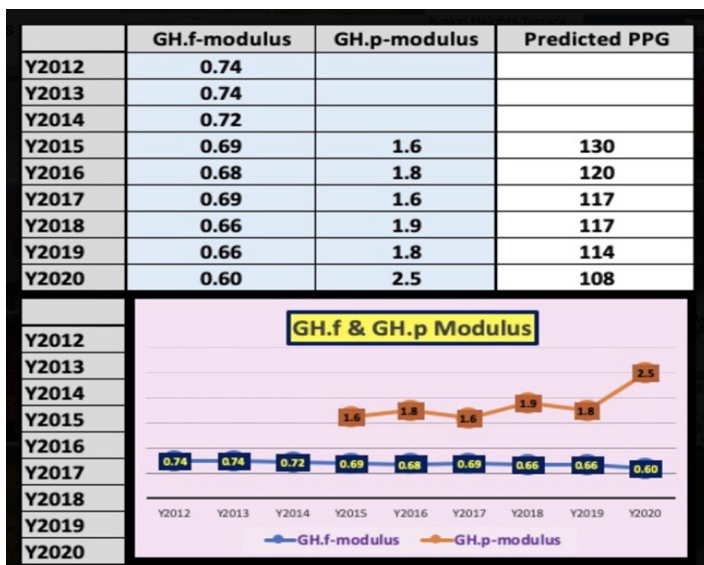


Figure 9: Linear elastic glucose (GH.f-modulus & GH.p-modulus)

$$GH.f\text{-modulus} = FPG / \text{Weight}$$

$$\text{Predicted PPG} = (0.97 * FPG) + (\text{carbs/sugar} * GH.p\text{-modulus}) - (\text{walking k-steps} * 5)$$

Due to his incomplete collected data for both health and lifestyle from 2012-2015, his calculation of GH.p only starts from 2015. There are two key observations of the following conclusive phenomena.

First, GH.f-modulus is continuously moving downward, from 0.74

in 2012 to 0.60 in 2020, which means that his health conditions of being overweight and diabetes are getting better year after year. Second, his GH.p-modulus values are between 1.6 and 2.5, which are expected values, based on his prior research. The special and highest GH.p-modulus value of 2.5 in 2020 is due to his excellent control on low carbs/sugar intake and glucose values resulting from no travel and routine lifestyle during the 2020 COVID-19 quarantine period.

The following table lists the reduction amount of each key variable from 2012 to 2020. They are listed in a form of (2012 amount, 2020 amount, and change amount). The only exceptional variable is the post-meal walking k-steps, which is an “increased” amount.

- Weight: (189, 170, -19)
- FPG: (140, 102, -38)
- PPG: (128, 108, -20)
- Food portion: (130%, 66%, -64%)
- Carbs/Sugar: (20.0, 12.48, -7.52)
- Walking steps: (0.5, 4.404, +3.904)

In other words, for his case, he has reduced ~50% of his annual average meal portion from 130% to 66% with a 19 lb. reduction in his weight (-10%), then his FPG would be decreased by 38 mg/dL (-27%) and his PPG would be reduced by 20 mg/dL (-16%). This proves the existence of a “straight-line route” of *from food portion control to weight and glucose control*.

Most T2D patients, who do not possess sufficient knowledge of food nutrition and have bad habits of overeating; therefore, their intake of carbohydrates, sugar, proteins, and fat would exceed the recommended amounts. As a result, this would cause problems with controlling both their weight and glucose. Of course, theoretically, when you get too much input energy via food, you must burn off the energy through physical activities and exercise. Unfortunately, most T2D patients are senior citizens. Generally speaking, most of them have a sedentary lifestyle; therefore, their choice and level of activity of exercise are generally limited. Therefore, the author’s advice to elderly diabetes patients is to focus on “post-meal walking”. They just need to walk with a normal speed for approximately 30 minutes after each meal, which should be sufficient for them. In this way, they will easily achieve their target of walking 10,000 steps per day by burning off ~400 calories per day.

The best food choice is limiting the amount of carbs/sugar and sodium with minimal fat and having sufficient high-quality proteins and vitamins. If T2D patients pay attention to their food and meal portion along with carbs/sugar intake amount, combined with exercise as mentioned above, then their weight and glucose will simultaneously improve.

Conclusions

In summary, the author describes his straightforward implementation model in the following four steps:

1. By reducing his weight from 189 lb. to 170 lb. (-19 lb. or -10% in total weight), cutting off about 50% of his original over-eating food portion size (from 130% in 2012 down to 66% in 2020, which is -7% of his annual food portion reduc-

tion from original amount, or -6% average annual reduction continuously). This food portion reduction will automatically reduce the intake amount of fat and carbohydrates along with strictly controlling his sugar and sodium amounts, while maintaining a sufficient intake amount of high-quality protein.

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geries. There are straight-line relationships existing among food, exercise, weight, and glucose that follow a simple and straight-line route of *from food portion control to weight reduction and arrive at glucose stability for both FPG and PPG [1-6]*.

Acknowledgement

Foremost, I would like to express my deep appreciation to my former professors: professor James Andrews at the University of Iowa, who helped develop my foundation in basic engineering and computer science, and professor Norman Jones at the Massachusetts Institute of Technology, who taught me how to solve tough scientific problem through the right attitude and methodology.

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