GH-Method: Math-Physical Medicine
Special Issue

Self-Recovery of Pancreatic Beta Cell's Insulin Secretion Based on 10+ Years Annualized Data of Food, Exercise, Weight, and Glucose Using GH-Method: Math-Physical Medicine (No. 339)

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Abstract

The author was inspired by reading 2 recently published medical papers regarding pancreatic beta cells insulin secretion or diabetes reversal via weight reduction. The weight reduction is directly related to the patient's lifestyle improvement through diet and exercise. He has published 6 medical papers on beta cells based on different stages in observations of his continuous glucose improvements; therefore, in this article, he will investigate food ingredients, meal portions, weight, and glucose improvement based on his 10+ years of collected big data. Here is the summary of his findings:

1) His successful weight reduction, from 220 lbs. in 2010 to 171 lbs. in 2020, comes from his food portion reduction and exercise increase.

2) His lower carbs/sugar intake amount, from 40 g in 2010 to 12 g in 2020, is resulted from his learned food nutrition knowledge and meal portion reduction, from 150% in 2010 to 67% in 2020.

3) His weight reduction contributes to his fasting plasma glucose (FPG) reduction, from 220 mg/dL in 2010 to 104 mg/dL in 2020. His carbs/sugar control and increased walking steps, from 2,000 steps in 2010 to ~16,000 steps in 2020, have contributed to his postprandial plasma glucose (PPG) reduction, from 300 mg/dL in 2010 to 109 mg/dL in 2020. When both FPG and PPG are reduced, his daily glucose is decreased as well, from 280 mg/dL in 2010 to 108 mg/dL in 2020.

4) His damaged beta cell's insulin production and functionality, most likely, have been repaired about 16% for the past 6 years or 27% in the past 10 years at a self-repair rate of 2.7% per year.

The conclusion from this paper is a 2.7% annual beta cells self-repair rate which is similar to his previously published papers regarding his range of pancreatic beta cells self-recovery of insulin secretion with an annual rate between 2.3–3.2%.

To date, the author has written 7 papers discussing his pancreatic beta cell's self-recovery of insulin secretion. In his first 6 papers, he used several different "cutting angles" or "analysis approaches" to delve deeper into this complex biomedical subject and achieved consistent

results within the range of 2.3–3.2% of the annual self-recovery rate.
He used a quantitative approach with precision to discover and reconfirm his pancreatic beta cell's health state by linking it backward step-by-step with his collected data of glucose, weight, diet, and exercise. He has produced another dataset for a self-repair rate of 2.7% which is located right in the middle between 2.3% and 3.2% from his previous findings.
In his opinion, type 2 diabetes (T2D) is no longer a non-reversible or non-curable disease. Diabetes is not only "controllable" but it is also "self-repairable", even though at a rather slow rate. He would like to share his research findings and his persistent efforts from the past decade with his medical research colleagues and to provide encouragement to motivate other T2D patients like himself to reverse their diabetes conditions.

Keywords: pancreatic beta cell, food, exercise, weight, glucose

Abbreviations: FPG: fasting plasma glucose; PPG: postprandial plasma glucose; T2D: type 2 diabetes; MPM: math-physical medicine; HbA1C: hemoglobin A1C

Introduction

The author was inspired by reading 2 recently published medical papers regarding pancreatic beta cells insulin secretion or diabetes reversal *via* weight reduction. The weight reduction is directly related to the patient's lifestyle improvement through diet and exercise. He has published 6 medical papers on beta cells based on different stages in observations of his continuous glucose improvements; therefore, in this article, he will investigate food ingredients, meal portions, weight, and glucose improvement based on his 10+ years of collected big data.

Methods

Background

To learn more about his developed GH-method: math-physical medicine (MPM) research methodology, readers can review his article, Biomedical research methodology based on GH-method: math-physical medicine, to understand his MPM analysis method [1].

Diabetes history

In 1995, the author was diagnosed with severe type 2 diabetes (T2D). His daily average glucose reached 280 mg/dL with a peak glucose at 398 mg/dL and his hemoglobin A1C (HbA1C) was at 10% in 2010. Since 2005, he has suffered many kinds of diabetes complications, including 5 cardiac episodes (without having a stroke), foot ulcer, renal complications, bladder infection, diabetic retinopathy, and hypothyroidism.

As of 9/30/2020, his daily average glucose is approximately 106 mg/dL and HbA1C at 6.1%. It should be mentioned that he started to reduce the dosage of his 3 different diabetes medications (maximum dosages) in early 2013 and finally stop taking them on 12/8/2015. In other words, his glucose record from 2016 to the present is totally "medication-free".

Beginning on 1/1/2012, he started to collect his weight value in the early morning and his glucose values 4 times a day: fasting plasma glucose (FPG) × 1 in the early morning and postprandial plasma glucose (PPG) × 3 at 2 h after the first bite of each meal. Since 1/1/2014, he also started to collect his carbs/sugar amount in grams and post-meal walking steps. Prior to these two dates, especially during the period of 2010–2012, the manually collected biomarkers and lifestyle details were scattered and unorganized. Therefore, those annualized data from 2010–2012 or 2014 were

guesstimated values with his best effort. It should be further mentioned that on 1/1/2013, he began to reduce his dosages of 3 diabetes medications step by step. By 1/1/2015, he was only taking 500 mg of Metformin for controlling his diabetes conditions. Finally, he completely ceased taking Metformin on 12/8/2015; therefore, since 1/1/2016, his body has been completely free of any diabetes medications.

Other research results

Recently, a Danish medical research team has published an article on JAMA which emphasizes a strengthen lifestyle program can "reverse" T2D. This program includes a weekly exercise (5–6 times and 30–60 min each time), daily walking more than 10,000 steps using smart phone to keep a record, personalized diet and nutritional guidance by healthcare professionals, etc. The observed results from this Danish report are patients' overall HbA1C reduction of 0.31%, and their diabetes medication dosage reduction from 73–26%.

Direct research report from UK also indicated that an aggressive weight reduction program can induce improvement on diabetes conditions. This UK program includes low-calories diet for 3–5 months with 825–853 K-calories per day, plus daily walking of 15,000 steps per day. The observed results from this UK report are patients' overall HbA1C reduction of 0.9%, weight reduction of 10 kg (or 22 lbs.), and reduced diabetes medication dosage as well.

The author's approach

Inspired by the results from the two European studies and based on his own collected big data over the past 10+ years, from 2010–2020, he decided to conduct a similar research on his own. He has separated his 10+ years data into 2 periods. The first period of 5 years, from 2010–2014, with partially collected and partially guesstimated data under different degrees of medication influence, and the second period of 6 years, from 2015–2020, with a complete set of collected raw data stored in software and sever without any medication influence.

His trend of thoughts includes a sequence from cause to consequence as listed below from top to bottom:

1) Food and meal's portion %
2) K-calories per day
3) Weight (lbs.)
4) FPG (mg/dL)
5) Carbs/sugar intake (grams)
6) Walking
7) PPG (mg/dL)
8) Daily glucose (mg/dL)

He has further conducted 9 calculations of correlation coefficient based on the above parameters to examine the degree of connections between any 2 elements of these total 8 parameters. It should be mentioned that the correlation coefficients can only be done between two data sets, or two curves.

More importantly, in addition to examining the raw data, he is also placing an emphasis on the annual change rate percentage, its trend, and their comparisons of these 8 parameters.

Results

The figure (Figure 1) indicates his background data table which includes his calculated annual averages of the 8 parameters plus proteins, fat, and daily K-calories, based on his daily data collected during 2010–2020.

The figure (Figure 2) depicts the annual change rate percentage of his food (meal portion %, K-calories, and carbs/sugar) and his weight. In this figure, meal portion and weight have similar change rates which means the less he eats, the lighter his weight. Also, carbs/sugar amount and K-calories have similar change rates which means the less his K-calories, the less his carbs/sugar intake amount.

	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	11-yrs Avg	6-yrs Avg
Carbs/Sugar (g)	40	35	33	30	25	20	15	14	15	13	12	23	15
Protein (g)	40	35	33	30	25	20	15	16	15	16	15	24	16
Fat (g)	40	35	33	30	22	18	11	11	9	11	7	21	11
K-Calories	2720	2380	2244	2040	1601	1288	885	860	829	844	706	1491	902
Meals Portion (%)	150	133	120	115	105	94	88	85	84	76	67	102	82
Weight (lbs)	220	198	189	183	177	175	173	174	171	173	171	182	173
Walking (Steps)	2000	3000	4000	7564	11767	14997	17017	17863	18458	15742	15882	11663	16660
Glucose (mg/dL)	280	230	165	132	135	129	119	117	116	114	108	150	117
PPG (mg/dL)	300	250	170	133	137	130	120	117	117	114	109	154	118
FPG (mg/dL)	220	170	150	135	128	121	117	120	114	115	104	136	115
Calculated Glucose	280	230	165	133	135	128	119	117	116	114	108	150	117
Calculated / Measured	100%	100%	100%	101%	100%	99%	100%	100%	100%	100%	100%	100%	100%
Note:	Start	Food	Data	Walking	MI Model	PPG, drug	FPG, carbs	CVD	CKD	Beta Cell	Neuro	with guess	more precise

	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	11-yrs Avg	6-yrs Avg
Carbs/Sugar (g)	40	35	33	30	25	20	15	14	15	13	12	23	15
K-Calories (/10)	272	238	224	204	160	129	88	86	83	84	71	1491	902
Meals Portion (%)	150	133	120	115	105	94	88	85	84	76	67	102	82
Weight (lbs)	220	198	189	183	177	175	173	174	171	173	171	182	173
	Y2010	Y2011	Y2012	Y2013	Y2014	Y2015	Y2016	Y2017	Y2018	Y2019	Y2020	11-yrs Avg	6-yrs Avg
Carbs/Sugar (g)	40	35	33	30	25	20	15	14	15	13	12	23	15
Walking (100 Steps)	20	30	40	76	118	150	170	179	185	157	159	117	167
Glucose (mg/dL)	280	230	165	132	135	129	119	117	116	114	108	150	117
PPG (mg/dL)	300	250	170	133	137	130	120	117	117	114	109	154	118
FPG (mg/dL)	220	170	150	135	128	121	117	120	114	115	104	136	115

Figure 1: Background data table.

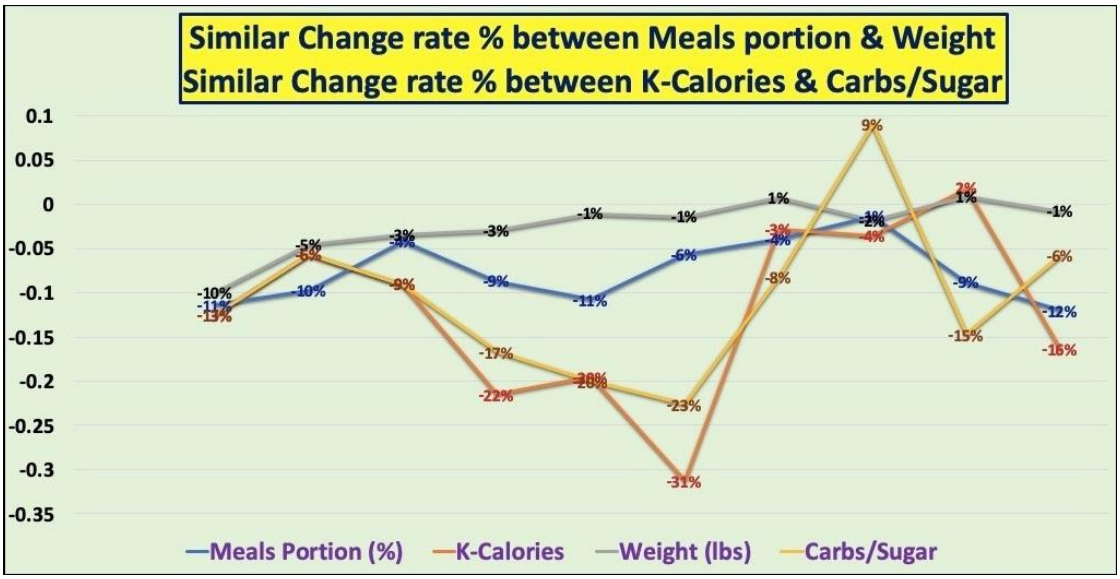

Figure 2: Annual change rates of weight and food (meal portion, K-calories, and carbs/sugar).

The figure (Figure 3) illustrates the similar trend of annual data of his weight and 3 food components (meal portion, K-calories, and carbs/sugar amount).

Exercise is a missing component from this figure which is also essential on weight reduction. The more he eats, the higher intake amounts of his K-calories and his carbs/sugar as well. During the past decade on his effort for weight reduction, he has focused on reducing both of his meal portion percentage and carb/sugar intake amount. As a result, he was able to reduce his weight from 220 lbs. (100 kg) and his average glucose from 280 mg/dL in 2010 to 171 lbs. (78 kg) and 106 mg/dL in 2020 (without any medication).

The figure (Figure 4) reflects the annual change rate percentage of his daily glucose, weight and carbs/sugar amount. In this figure, the change rates of his glucose and weight are remarkably similar, almost a mirror image, which indicates the lower his weight, the lower his glucose. This finding matches the two European studies and the common knowledge possessed by healthcare professionals. The reason for the obviously mismatched change rates between

carbs/sugar and glucose or weight is due to the missing component of exercise which is equally important on glucose reduction.

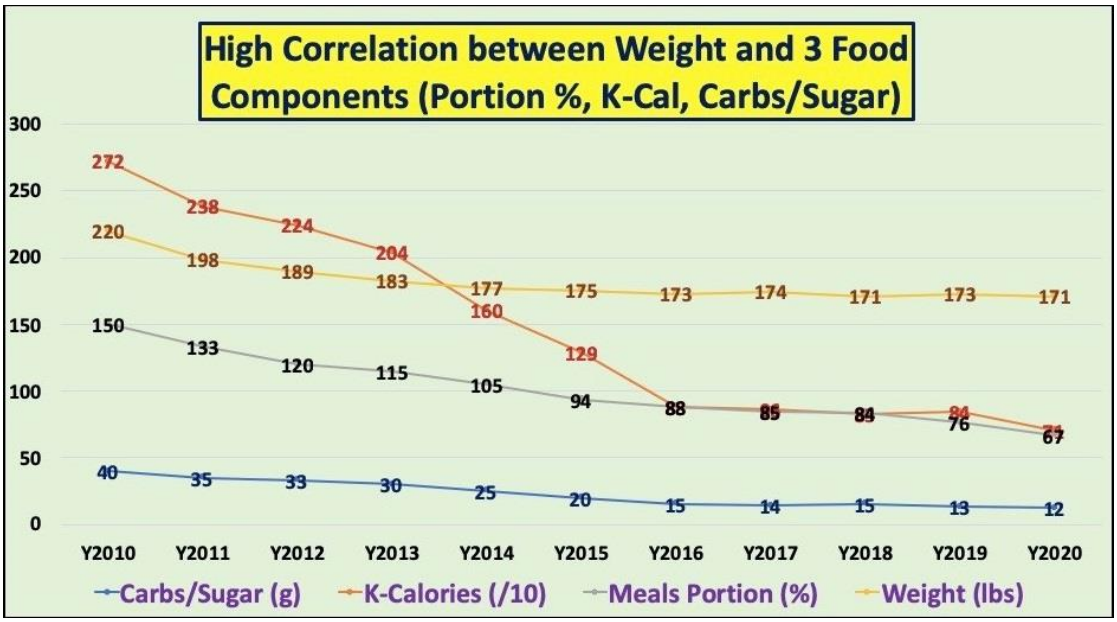

Figure 3: Annual change rates of weight and food (meal portion, K-calories, and carbs/sugar).

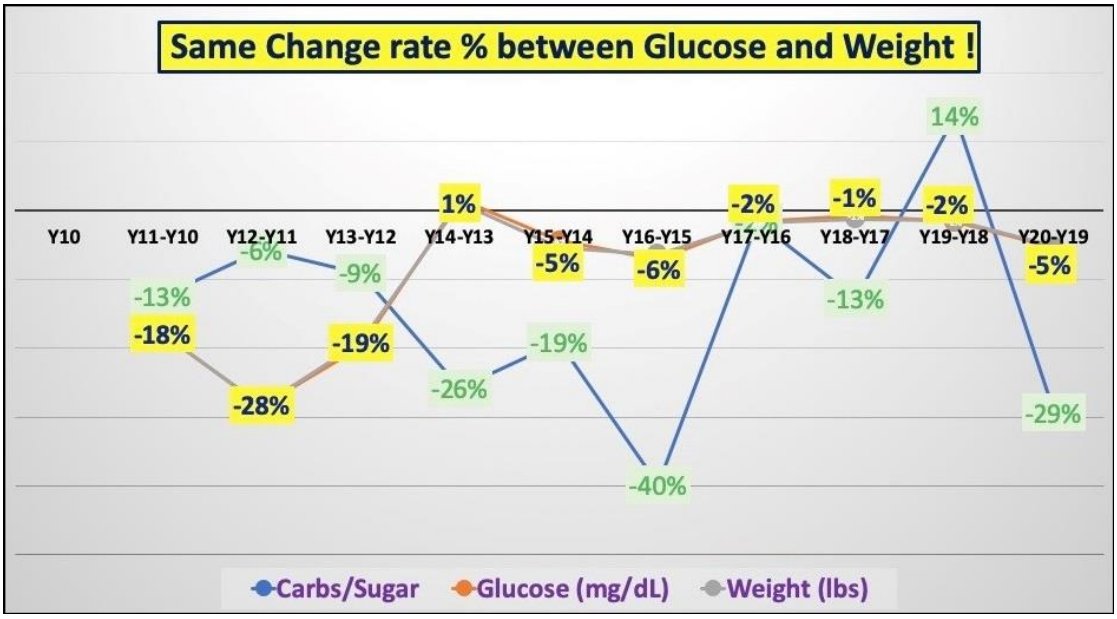

Figure 4: Annual change rates of weight, glucose, and carbs/sugar.

The figure (Figure 5) focuses exclusively on the relationships among data of glucose, carbs/sugar, and exercise. The positive correlation coefficient between glucose and carbs/sugar is expressed by these 2 similar moving trends. On the other hand, the negative correlation coefficient between glucose and exercise (walking) is expressed by these 2 opposite moving trends.

The figures (Figure 6, 7, and 8) collectively together indicate the 9 sets of calculated correlation coefficients among those 8 listed elements in the above section of methods. A better illustration of these 3 figures can be found in a table,

where all of the calculated correlations are above 90%, which means they are highly connected to each other (Figure 9). Even the correlation of -89% between glucose and walking exercise is also extremely high in a negative manner.

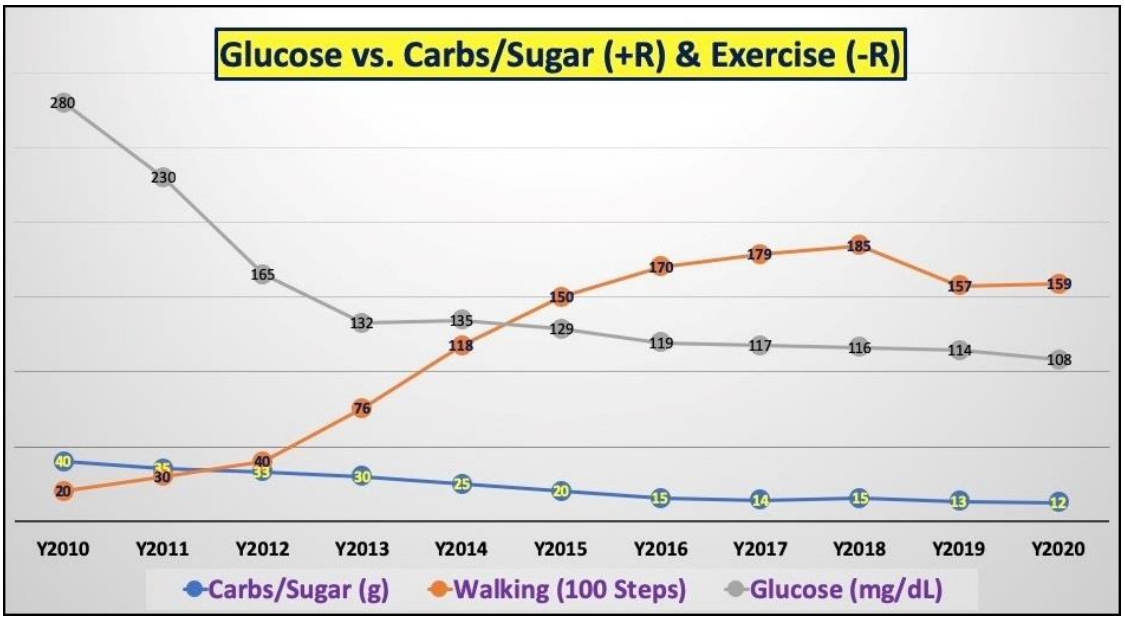

Figure 5: Annual data of weight, glucose, and carbs/sugar.

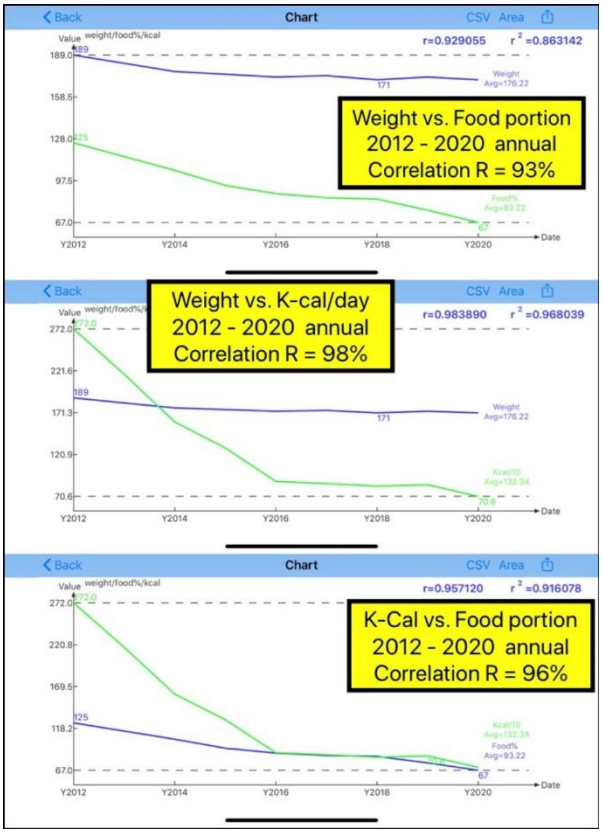

Figure 6: Correlation coefficients among weight, K-calories, meal portion.

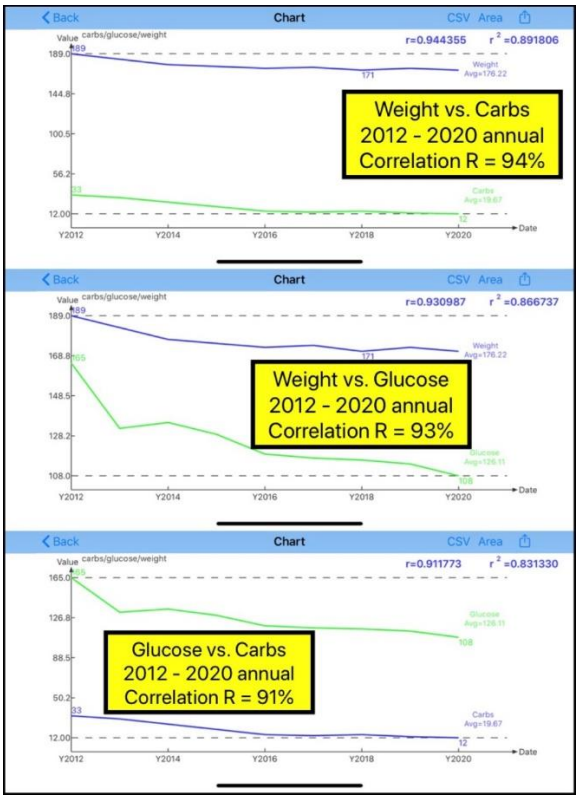

Figure 7: Correlation coefficients among weight, glucose, carbs/sugar.

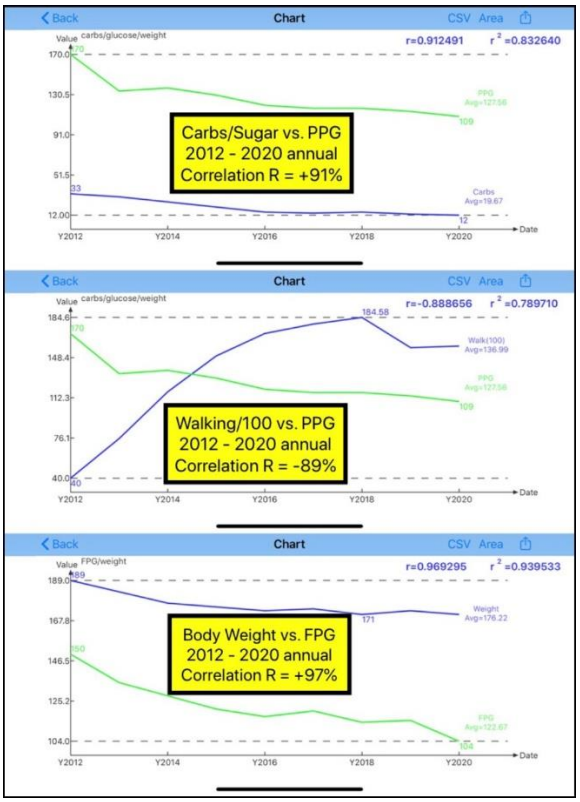

Figure 8: Correlation coefficients among PPG, carbs/sugar, walking, FPG, weight.

Correlation ®	Weight	Food Portion	K-Cal / day	Carbs/Sugar	Glucose	PPG	FPG	Walking
Weight		93%	98%	94%	93%		97%	
Food Portion	93%		96%					
K-Cal / day	98%	96%						
Carbs/Sugar	94%				91%	91%		
Glucose	93%			91%				
PPG				91%				-89%
FPG	97%							
Walking Steps						-89%		

Figure 9: A combined data table of 9 correlation coefficients among 8 elements.

The figure (Figure 10) reveals the detailed annual change rates of 8 elements for a 10+ year period from 2010–2020. It should be pointed out that his average change rates within 6 years from 2015 through 2020 are 2.7% per year for both FPG and PPG, and 3.4% for daily glucose. This conclusion is similar to his 6 previously published papers regarding his pancreatic beta cell's self-recovery rate of insulin secretion. Most likely, his beta cells insulin production and functionality have been repaired about 16% during the past 6 years or 27% during the past 10 years at a self-repair rate of 2.7% per year.

Reduction %	Y10	Y11-Y10	Y12-Y11	Y13-Y12	Y14-Y13	Y15-Y14	Y16-Y15	Y17-Y16	Y18-Y17	Y19-Y18	Y20-Y19	10-yrs Rate	5-yrs Rate
Meals Portion (%)		-11%	-10%	-4%	-9%	-11%	-6%	-4%	-1%	-9%	-12%	-8%	-6%
K-Calories		-13%	-6%	-9%	-22%	-20%	-31%	-3%	-4%	2%	-16%	-12%	-10%
Weight (lbs)		-10%	-5%	-3%	-3%	-1%	-1%	1%	-2%	1%	-1%	-2%	-0.5%
Carbs/Sugar		-13%	-6%	-9%	-17%	-20%	-23%	-8%	9%	-15%	-6%	-11%	-8%
Reduction %	Y10	Y11-Y10	Y12-Y11	Y13-Y12	Y14-Y13	Y15-Y14	Y16-Y15	Y17-Y16	Y18-Y17	Y19-Y18	Y20-Y19	10-yrs Rate	5-yrs Rate
Carbs/Sugar		-13%	-6%	-9%	-26%	-19%	-40%	-2%	-13%	14%	-29%	-14%	-14%
Glucose (mg/dL)		-18%	-28%	-20%	2%	-4%	-7%	-2%	-1%	-2%	-5%	-9%	-3.4%
Weight (lbs)		-18%	-28%	-19%	1%	-5%	-6%	-2%	-1%	-2%	-5%	-9%	-3.2%
FPG (mg/dL)		-23%	-12%	-10%	-6%	-6%	-3%	2%	-5%	1%	-9%	-7%	-2.7%
PPG (mg/dL)		-23%	-12%	-10%	-6%	-6%	-3%	2%	-5%	1%	-9%	-7%	-2.7%

Figure 10: A combined data table of annual change rates of 7 elements, especially glucose change rates of 2.7%.

Here is the summary of his findings:

1) His successful weight reduction, from 220 lbs. in 2010 to 171 lbs. in 2020, comes from his food portion reduction and exercise increase.
2) His lower carbs/sugar intake amount, from 40 g in 2010 to 12 g in 2020, is resulted from his learned food nutrition knowledge and meal portion reduction, from 150% in 2010 to 67% in 2020.
3) His weight reduction contributes to his FPG reduction, from 220 mg/dL in 2010 to 104 mg/dL in 2020. His carbs/sugar control and increased walking steps, from 2,000 steps in 2010 to ~16,000 steps in 2020, have contributed to his PPG reduction, from 300 mg/dL in 2010 to 109 mg/dL in 2020. When both FPG and PPG are reduced, his daily glucose is decreased as well, from 280 mg/dL in 2010 to 108 mg/dL in 2020.
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Summary

To date, the author has written 7 papers discussing his pancreatic beta cell's self-recovery of insulin secretion. In his first 6 papers [2–7], he used several different "cutting angles" or "analysis approaches" to delve deeper into this complex biomedical subject and achieved consistent results within the range of 2.3–3.2% of annual self-recovery rate.

He used a quantitative approach with precision to discover and reconfirm his pancreatic beta cell's health state by linking it backward step-by-step with his collected data of glucose, weight, diet, and exercise. He has produced another dataset for a self-repair rate of 2.7% which is located right in the middle between 2.3% and 3.2% from his previous findings.

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