ISSN: 2690-0726

Research Article

Journal of Educational & Psychological Research

Behavior Psychology and Body Weight Reduction of a Type 2 Diabetes Patient Using GH-Method: Math-Physical Medicine or Mentality-Personality Modeling (No. 308)

Gerald C Hsu

eclaireMD Foundation, USA

***Corresponding author**
Gerald C Hsu, eclaireMD Foundation, USA

Submitted: 16 Nov 2022; **Accepted**: 23 Nov 2022; **Published**: 30 Nov 2022

Citations: *Hsu, G. C. (2022). Behavior Psychology and Body Weight Reduction of a Type 2 Diabetes Patient Using GH-Method: Math-Physical Medicine or Mentality-Personality Modeling (No. 308). J Edu Psyc Res, 4(3), 512-518.*

Abstract

In this article, the author used his 10-year data of body weight and some prominent lifestyle details, mainly food portions, and daily exercise, to address his weight reduction trend pattern and his progressive lifestyle behavior modifications. The research methodology used here is the GH-Method: math-physical medicine (MPM) approach which has been developed by the author during the past decade. This "Progressive Behavior Modification" concept is also a part of his Mentality-Personality Modeling (MPM). He addresses the quantitative linkage between physiological obesity phenomena and behavior psychological influences of an obese patient.

He created a geometric presentation model with the meal portion percentage as the x-axis, daily walking steps as the y-axis, and daily weight as the z-axis (Figure 1). He decided to "fold over" the z-axis and superimpose it with the x-y planar space in a form of a "radio wave" format. Under this created 3D presentation on a 2D planar space, the weight reduction trend pattern becomes ultra-clear. These x-axis and y-axis values represent his progressive lifestyle behavior modifications (mentality-personality model) over the past 10 years, while the z-axis values present his obesity physiological outcomes (math-physical medicine).

Over the past 10 years, the path of his annual weight movement started from the upper right corner (subregion E5 in 2010), moving with a ~45-degree downward angle before arriving at the near upper middle portion (subregion D4 in 2013), and then continue dropping to the lower middle location (subregion C1 in 2018).

In summary, his entire body weight moving path is a 45-degree downward angle to the left and then straight down to the bottom. His annualized average daily weight has been reduced from the starting point of 220 lb. in 2010 through the "reflection point" of 183 lb. in 2013, and then straight down to the ending point of 171-173 lb. in 2018-2020. The triangular relationship among diet, exercise, and daily weight can be easily observed on this "weight reduction trend pattern" diagram (Figure 1).
Figure 1: Weight Reduction Trend Pattern Diagram Among Body Weight, Meal Portion %, and Daily Walking Steps in 10 years (2010-2020)

Through analyzing the distinctive daily glucose trend patterns, the personality traits and behavior psychological characteristics of this T2D patient can be revealed instantly and clearly. As a result, a more practical guidance of "progressive behavior modification" can be provided to other T2D patients in order to improve their medical conditions for chronic diseases, where some are caused by obesity.

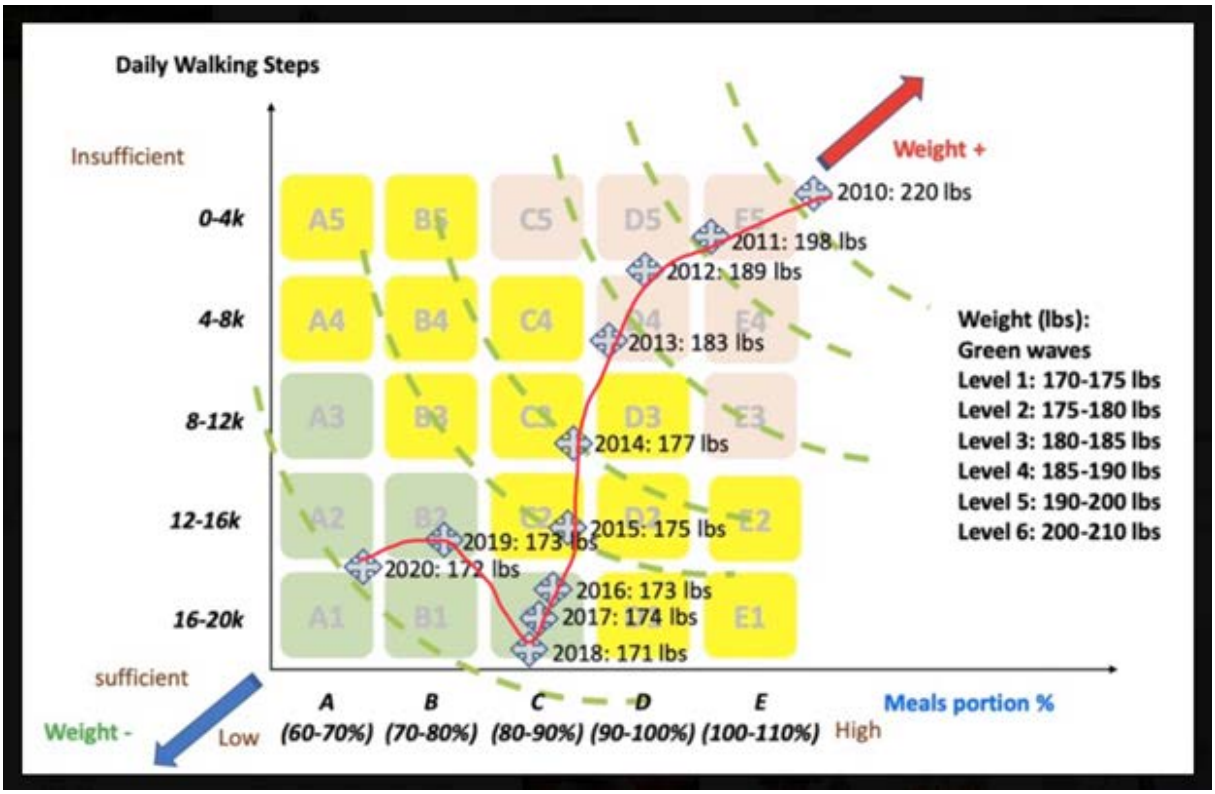


Figure 1: Weight Reduction Trend Pattern Diagram Among Body Weight, Meal Portion %, and Daily Walking Steps in 10 years (2010-2020)

Introduction

In this article, the author used his 10-year data of body weight and some prominent lifestyle details, mainly food portions, and daily exercise, to address his weight reduction trend pattern and his progressive lifestyle behavior modifications. The research methodology used here is the GH-Method: math-physical medicine (MPM) approach which has been developed by the author during the past decade. This "*Progressive Behavior Modification"* concept is also a part of his Mentality-Personality Modeling (MPM). He addresses the quantitative linkage between physiological obesity phenomena and behavior psychological influences of an obese patient.

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 (Reference 1).

Any system, whether medical, political, economic, engineering, biological, chemical, or even psychological has 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 the 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 structures. This system structure includes human organs for a biomedical system, the human brain for a neurological or mental system, or a steel plate for a 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 a certain way due to internal causes, reasons, or stressors, we can try to develop some guesses or formulate some reasonable 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 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 a different kind of condition 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 is 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 create a hypothesis. In addition, some engineering modeling techniques, such as the finite element method and computer science tools, including software, artificial intelligence (AI), and big data analytics can offer great assistance in the 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 arithmetical formula for others to adopt this easier way of thinking and understanding 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.

Obesity & Diabetes Research

Since 1995, the author was a severe T2D patient, who was obese. He developed many serious complications and finally, in 2010, they became life-threatening. Therefore, he spent the next 10 years self-study and researching obesity, diabetes, metabolism, and endocrinology, in order to save his own life. He studied the following subject relationships between cause/reason and consequence/result (from top to bottom):

· Poor Lifestyle management
· Metabolic disorder
· Obesity
· Chronic diseases
· Complications
· Weak Immunity
· Various diseases lead to death

His first priority was to focus on learning both lifestyle and metabolism before dealing with his obesity and diabetes issues. Then, he was able to concentrate on obesity along with his parallel research on diabetes.

The author immigrated to the United States as a young student with a body weight of 145 pounds and a BMI of 20.8. By 2010, he has had diabetes for over 15 years and weighed 220 pounds or a BMI of 32.5.

He then spent his first four years, from 2010 to 2013, 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 chronic diseases. After his first 4-years of self-learning, he then spent the entire year of 2014 developing a complex 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). He applied the concept of topology and the approximation engineering modeling technique of the finite element method to develop this metabolism model which became the cornerstone of his future medical research work. His overall health conditions started to be improved noticeably after 2014.

Starting from 2015, he spent three consecutive years, from 2015 to 2017, discovering the characteristics and behaviors of this complex "wild beast" of glucose. His major objective is to truly understand the "inner characteristics" of glucose, not just use the 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 calm it down. As a result, during this period of 3-years, he has developed 4 prediction models, which include Weight, PPG, FPG, and HbA1C with an extremely high prediction accuracy (95% to 99%) to reach 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 intake amount) would provide ~38% and exercise (post-meal 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, a high weather temperature contributes ~5%, whereas 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 statistical connection between his FPG and his body weight with a >90% correlation coefficient. 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 his FPG and PPG have decreased in the past 6 to 8 years at an annual rate of 2.2% to 3.2%. In other words, his pancreatic beta cells have been self-regenerating or self-repairing about 13% to 26% over these 6-8 years. He then thought about FPG as being a good indicator of how healthy his pancreatic beta cells are since there are no food intake and exercise while sleeping. During the last 5 years, his body weight has been maintained at around 172 lb. Besides, his body has been medication-free over the past 5-years as well. It makes sense that FPG carries a significant and clear message about his health status of pancreatic beta cells; therefore, it can be served as the baseline of his overall glucose predictions.

A detailed explanation of his glucose research is provided because weight and glucose are inter-wound together and are based on lifestyle management which leads to metabolism balance.

Weight Trend-Pattern Diagram

A typical patient with chronic disease faces three major challenges:

(1) Availability of accurate and precise disease information with

either physical evidence or quantitative proofs, not just some general qualitative descriptions that may include false or commercial-driven news over the internet (a knowledge issue).
(2) Awareness of the disease's specific status and overcoming self-denial in order to take effective actions. The most difficult barrier to overcome is having determination, willpower, and persistence in lifestyle change (behavior issues).
(3) An effective, and ease-of-use technology-based tool to accurately predict biomedical outcomes and also guide patients (a technology issue).

The MPM methodology and its related diabetes research work cover the scope of this first issue, knowledge. The third issue, technology, has also been discussed in his previously published papers (Reference 2). This investigation report addresses the second issue, behavior, specifically a patient's lifestyle behavior regarding his diet control and exercise. Beyond acquiring accurate and sufficient knowledge of obesity and diabetes, the resistance to food temptation and diligence with daily exercise affect every patient on a daily basis. Both of these lifestyle behaviors regarding food and exercise require strong determination, willpower, and persistence to achieve the goal of controlling obesity and diabetes. These concerns are related to a patient's personality traits; however, lifestyle habits and behaviors can be learned and gradually modified (References 10 to 13).

The author has collected a total of two million data on his medical conditions and lifestyle details for the past ten years (2010 to 2020). In this particular study, he only utilized three subsets of his collected and stored big data: body weight measured in the early mornings before breakfast, meal portion percentage of the amount of his "normal" meal, and the daily total number of walking steps. It should be noted that there are many different types of exercise. However, for a senior citizen like the author himself, who has suffered many severe diabetes complications in the past, he found that walking is his best choice.

As he described in his diabetes research section, his learned knowledge and research results of diabetes control are progressively introduced and included in his data collection software as the data become available. In short, he studied both diseases and nutrition from 2010 to 2013, then started collecting his daily weight data since 2012, daily walking steps since 2013, and detailed meal portion percentage since 2016. Before accumulating this additional data, he collected some partial data, not on a daily basis in an organized fashion similar to the periods after the starting years. However, his best guesstimated annualized data, prior to those starting years, are still able to provide accurate annualized information. Therefore, in the data table, the red-colored data are his guesstimated annual data based on partially collected data, while the black-colored data are collected real data based on each meal and each day within an entire year (Figure 2).

	Weight	Meal Portion %	Daily Walk (/100)
Y2010	220	114	12
Y2011	198	100	30
Y2012	189	95	40
Y2013	183	93	76
Y2014	177	90	118
Y2015	175	89	150
Y2016	173	88	170
Y2017	174	85	179
Y2018	171	84	185
Y2019	173	76	157
Y2020	172	68	162

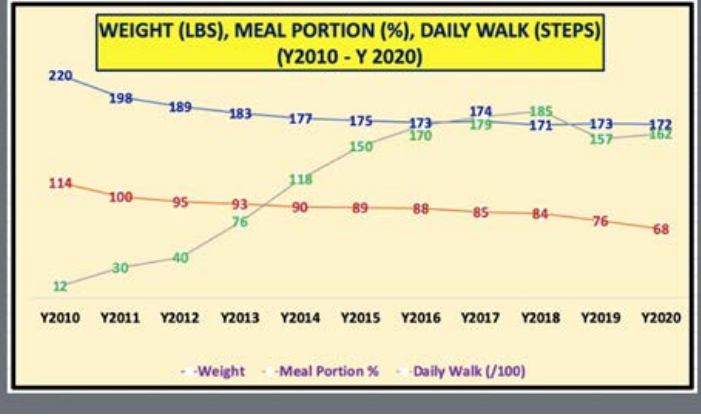


Figure 2: Background Data Table and Line Chart of Weight, Meal Portion %, and Daily Walking Steps (2010-2020)

In order to demonstrate the results of his ***"trend pattern analysis",*** he created a modified two-dimensional (2D) planar space which can present three-dimensional (3D) data information. Initially, he set his x-coordinate as his meal portion percentage from low scale to high scale with the following 5 segments:

Segment A: 60-70 %
Segment B: 70-80 %
Segment C: 80-90 %
Segment D: 90-100 %
Segment E: 100-110 %

Next, he set his y-coordinate as his daily walking steps from high scale to low scale with the following 5 segments:

Segment 1: 16 - 20k steps
Segment 2: 12 - 16k steps
Segment 3: 8 - 12k steps
Segment 4: 4 - 8k steps
Segment 5: 0 - 4K steps

Therefore, these x- and y-axes constitute a 2D planar space with a total of 25 sub-regions inside, such as A1 through E5.

Lastly, he set his "pseudo" z-coordinate" as his daily body weight levels from low scale (lower left corner) to high scale (upper right corner) in a "radio-wave" format with the following 6 segments:

Segment 1: 170-175 lb.
Segment 2: 175-180 lb.
Segment 3: 180-185 lb.
Segment 4: 185-190 lb.
Segment 5: 190-200 lb.
Segment 6: 200-210 lb. - his weight of 220 lb. in 2010 was beyond this segment.

However, for a better view, he has superimposed his z-axis on his 2D planar x-y space with a "radio-wave" format to show their different weight levels (Figure 1). In this presentation, the reader of this article can easily observe the weight reduction trend pattern from 2010 to 2020 along with their respective relationship with meal portion percentage and daily walking steps.

From observing this weight trend pattern diagram, patients can modify their behavior one step at a time, by taking little steps on a smaller scale. This is what the author defined as a "progressive behavior modification".

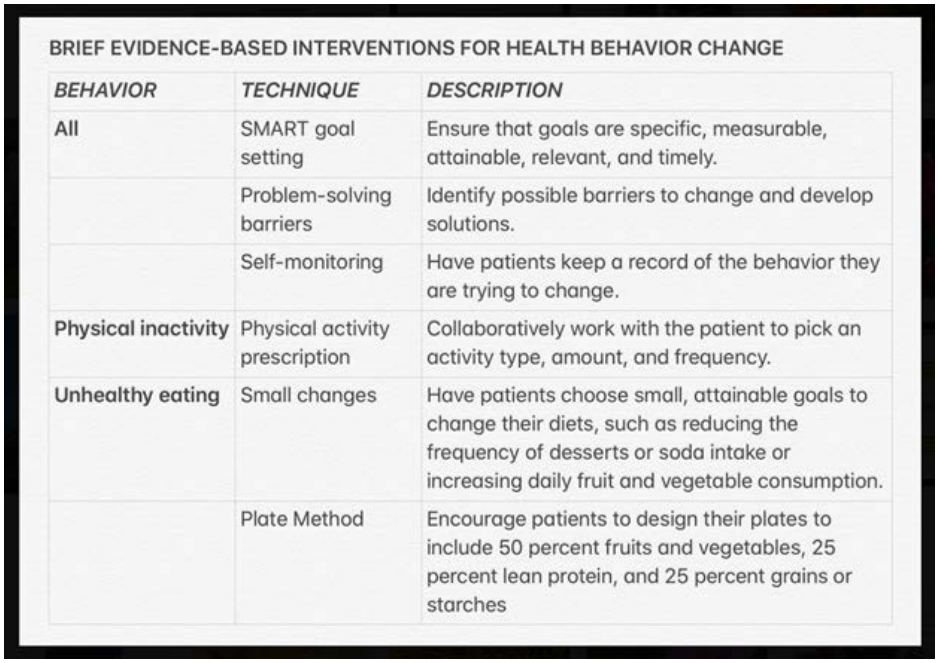
Behavior Psychology

On August 28, 2018, Dr. Bryn Farnsworth stated that *"Behavioral psychology is the study of how our behaviors relate to our mind – it looks at our behavior through the lens of psychology and draws a link between the two."*

FPM is an editorially independent, peer-reviewed journal published by the American Academy of family physicians. Here is an excerpt from the March-April 2018 edition, "Using these brief interventions, you can help your patients make healthy behavior changes"(Reference 10).

"Effectively encouraging patients to change their health behavior is a critical skill for primary care physicians. Modifiable health behaviors contribute to an estimated 40 percent of deaths in the United States. Tobacco use, poor diet, physical inactivity, poor sleep, poor adherence to medication, and similar behaviors are prevalent and can diminish the quality and length of patients' lives. Research has found an inverse relationship between the risk of all-cause mortality and the number of healthy lifestyle behaviors a patient follows.

Key Points (See Figure 3):
(1) Modifiable health behaviors, such as poor diet or smoking, are significant contributors to poor outcomes.
(2) Family physicians can use brief, evidence-based techniques to encourage patients to change their unhealthy behaviors.
(3) Working with patients to develop health goals, eliminate barriers, and track their own behavior can be beneficial.
(4) Interventions that target specific behaviors, such as prescribing physical activity for patients who don't get enough exercise or providing patient education for better medication adherence, can help patients to improve their health."



BRIEF EVIDENCE-BASED INTERVENTIONS FOR HEALTH BEHAVIOR CHANGE

BEHAVIOR	*TECHNIQUE*	*DESCRIPTION*
All	SMART goal setting	Ensure that goals are specific, measurable, attainable, relevant, and timely.
	Problem-solving barriers	Identify possible barriers to change and develop solutions.
	Self-monitoring	Have patients keep a record of the behavior they are trying to change.
Physical inactivity	Physical activity prescription	Collaboratively work with the patient to pick an activity type, amount, and frequency.
Unhealthy eating	Small changes	Have patients choose small, attainable goals to change their diets, such as reducing the frequency of desserts or soda intake or increasing daily fruit and vegetable consumption.
	Plate Method	Encourage patients to design their plates to include 50 percent fruits and vegetables, 25 percent lean protein, and 25 percent grains or starches

Figure 3: Using Brief Evidence-Based Interventions Can Help Chronic Diseases Patients Make Healthy Behavior Changes

From the articles in References 10-13, we can see the close relationship between health and lifestyle behavior psychology.

Results

Figure 2 shows the background data table and line chart of 3 values, average daily weight, average meal portion percentage, and average daily walking steps. Body weight is directly proportional to food intake quantity (energy input) and reversed overall exercise level (energy output). Therefore, on this line chart of a time-series diagram, body weight and food portion percentage are moving in unison with a positive correlation coefficient (+88%), while body weight and daily walking steps are moving in opposite directions with a negative correlation coefficient (-89%) as shown in Figure 4. In 2010, the author's weight was 220 lb., moving forward with lower daily glucose, he weighed 175 lb. in 2015 and finally reached 172 lb. in 2020.

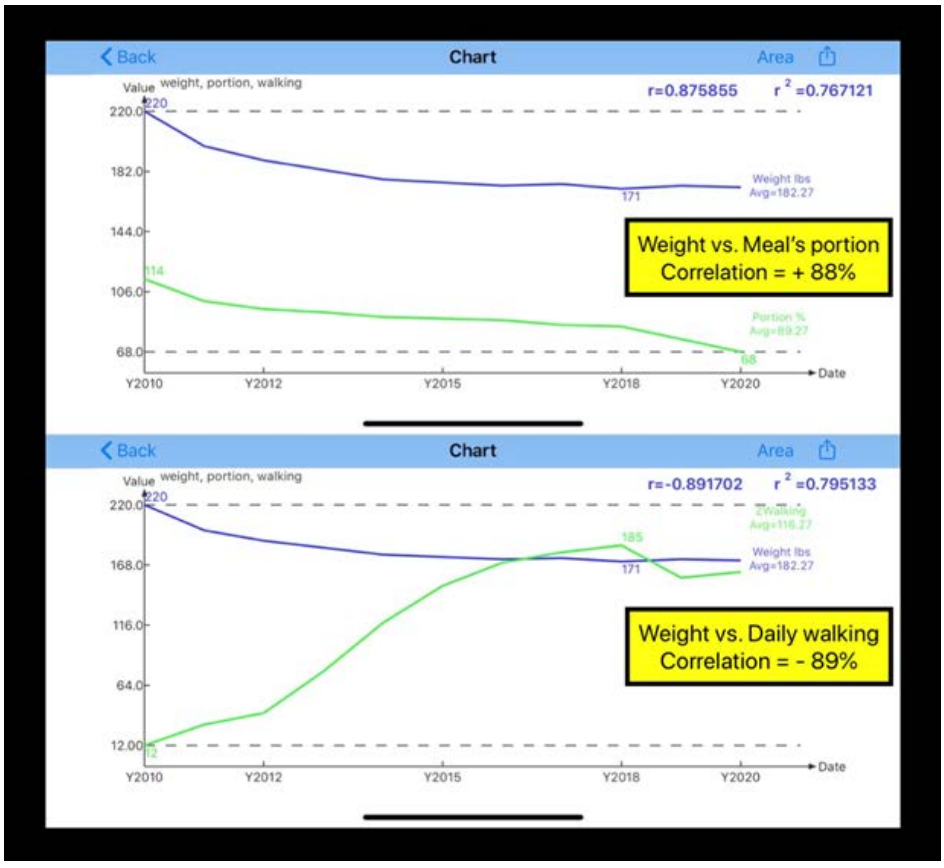


Figure 4: Two High Correlations from Time-Series Diagrams of Weight vs. Meal's Portion % and Weight vs. Daily Walking Steps (2010-2020)

Beginning in 2010, he reduced his meal portion percentage from 114% per meal down to 68% per meal in 2020. Over this 10-year period, he increased his daily walking exercise from 1,200 steps per day in 2010 up to 18,500 steps per day in 2018. Due to his heavy travel schedule to attend 65+ international medical conferences, his daily walking was interrupted and reduced to 16,200 steps in 2020. His weight reduction in this trend pattern diagram demonstrates what he previously stated, ***control obesity from the most fundamental core level by reducing food portions and increasing exercise levels.***

In Figure 1, he created a presentation diagram of the "radio-wave" glucose format on a 2D planar space. This diagram actually depicts his "weight reduction trend pattern" with his lifestyle behavior modifications. It is not an easy task to ***reduce*** one's food intake quantity from 100% above the normal portion to 2/3 (68%) of the normal portion while ***maintaining*** daily walking steps of ~16,000 (6.7 miles or 10.7 km) for 6 years. It requires strong determination, willpower, and persistence to maintain these disciplined behaviors for 6 to 8 years. The author has done this task successfully; therefore, he saved his own life from the life-threatening complications of diabetes, such as five cardiovascular episodes and renal difficulties. The accomplishments started with his weight reduction from 220 lb. (100 kg or BMI 32.5) in 2010 down to 172 lb. (78 kg or BMI 25.4) in 2020. In Figure 1, we can see clearly that these lifestyle behavior modification efforts finally paid off in the long run. ***There is nothing better than living a healthier and longer life.***

His daily body weight, represented with the gray star symbols on the pseudo-z-axis data, starting from the upper right corner of 220 lb. in 2010 (subregion E5) moving toward the lower left direction with a ~45-degree downhill slope until 2013 (subregion D4) and then dropping "straight downward" like a free-falling object until his weight reached 171 lb. in 2018 (subregion A3). All of these achievements are acquired from having the correct knowledge and being persistent with his diet and exercise regimen. This case has demonstrated the patient's strong determination, willpower, and persistence along with his continuous struggle to maintain his levels of diet portion control and constant walking exercise over the past 10 years.

Conclusion

In summary, his entire body weight moving path is a 45-degree downward angle to the left and then straight down to the bottom. His annualized average daily weight has been reduced from the starting point of 220 lb. in 2010 through the "reflection point" of 183 lb. in 2013, and then straight down to the ending point of 171-173 lb. in 2018-2020. The triangular relationship among diet, exercise, and daily weight can be easily observed in this"-weight reduction trend pattern" diagram (Figure 1).

Through analyzing the distinctive daily glucose trend patterns, the personality traits and behavior psychological characteristics of this T2D patient can be revealed instantly and clearly. As a result, more practical guidance on *"progressive behavior modification"* can be provided to other T2D patients in order to improve their medical conditions for chronic diseases, where some are caused by obesity.

References

1. Hsu, G. C. (2019). GH-Method: Methodology of math-physical medicine (No. 54). J Cancer Immunol Therapy, 2(1), 14-15.
2. Hsu Gerald, C. (2020). Controlling type 2 diabetes via artificial intelligence technology using GH-Method: math-physical medicine (No. 125). Journal of Clinical & Experimental Immunology, 5, 130-131.
3. Hsu Gerald, C. (2020). Guesstimate probable partial self-recovery of pancreatic beta cells using calculations of annualized glucose data using GH-Method: math-physical medicine (No. 139). Int Jou Diab&Endocrinol: IJDE-103.
4. Hsu, G. C. (2020). Using wave characteristic analysis to study T2D patient's personality traits and psychological behavior (GH-Method: Math-Physical Medicine) (No. 52). J Addict Res, 4(1), 12-13.
5. Hsu Gerald C. (2019). Trending pattern analysis and progressive behavior modification of two clinic cases of correlation between patient psychological behavior and physiological characteristics of T2D Using GH Method: math-physical medicine & mentality-personality modeling (No. 53).
6. Hsu Gerald, C. (2020). Using wave characteristic analysis to study T2D patient's personality traits and psychological behavior based on GH-Method: Math-Physical Medicine (No. 59). Journal of Addiction Research, 4, 12-13.
7. Hsu Gerald, C. (2019). Using GH-Method: math-physical medicine, mentality-personality modeling, and segmentation pattern analysis to compare two clinic cases about linkage between T2D patient's psychological behavior and physiological characteristics (No. 72).
8. Hsu Gerald C (2019) eclaireMD Foundation, USA. "Using artificial intelligence technology to overcome some behavioral psychological resistance for diabetes patients on controlling their glucose level using GH-Method: math-physical medicine & mentality-personality modeling (No. 93)."
9. Hsu, G. C. (2020). A comparison of three glucose measurement results during COVID-19 period using GH-Method: math-physical medicine (No. 303). Journal of Biotechnology and Immunology, 2(4), 2.
10. Hooker, S., Punjabi, A., Justesen, K., Boyle, L., & Sherman, M. D. (2018). Encouraging health behavior change: eight evidence-based strategies. Family Practice Management, 25(2), 31-36.
11. American Psychological Association, "Making lifestyle changes that last: Starting small, focusing on one behavior at a time and support from others can help you achieve your exercise or other health-related goals.
12. Hohman, M. (2019). The Psychology of Adhering to a Treatment Plan: Why Patients Fail and How Providers Can Help.
13. Harvard Women's Health Watch. (2012). Why behavior change is hard - and why you should keep trying: Successful change comes only in stages. How long it takes is an individual matter.