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Research Article

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A neurological communication model between brain and stomach/ liver/pancreas via central nervous system regarding postprandial plasma glucose production using GH-Method: Math-Physical Medicine and viscoelastic energy method (No. 948, VMT#347, 10/30/2023)

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Abstract

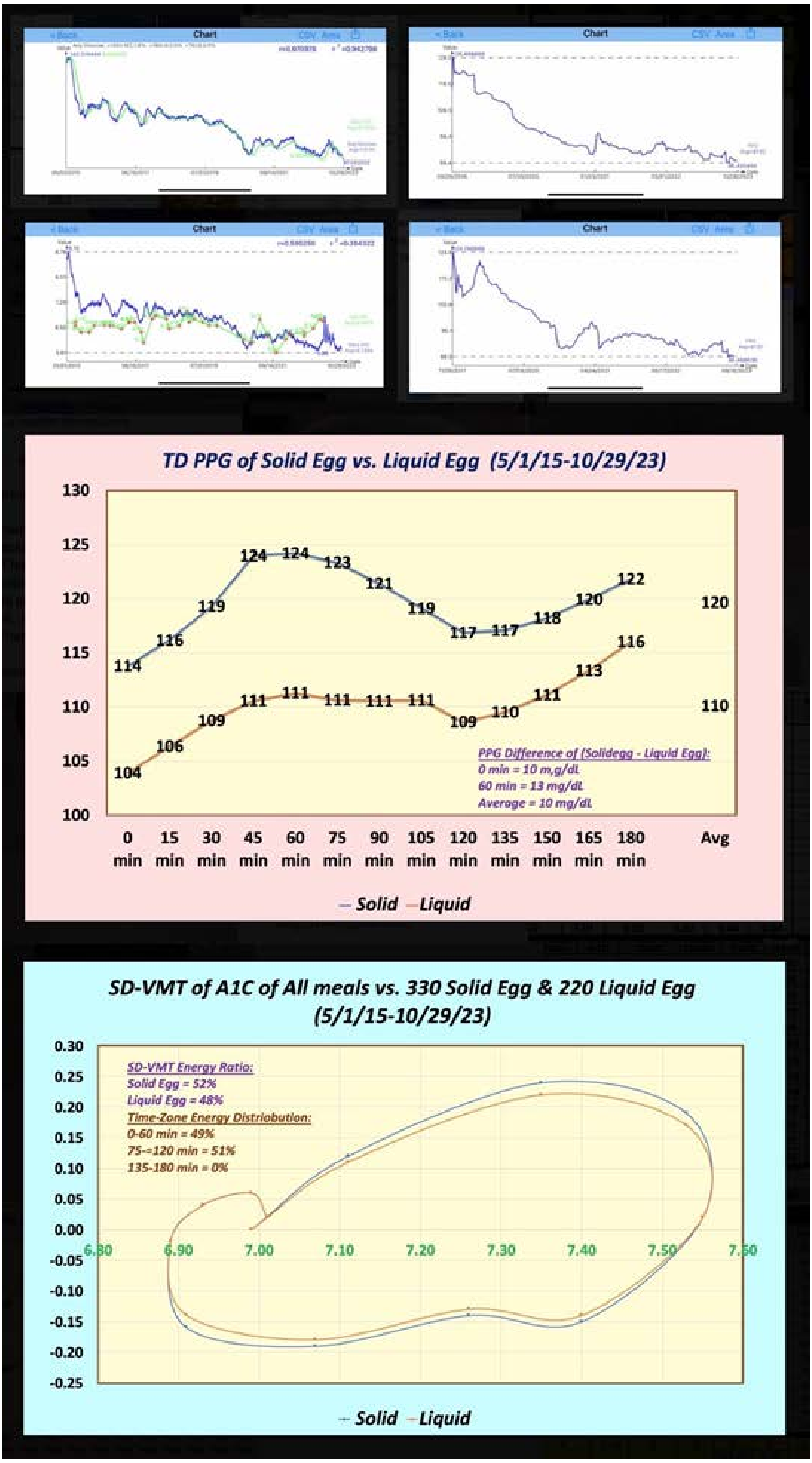
The author has developed an AI software tool grounded in optical physics theory and linear elasticity engineering theory. This AI research tool accurately estimates his carbohydrate and sugar intake amount with a 95% prediction accuracy and the predicted value of his post-meal glucose (PPG) levels with a remarkable 99.7% prediction accuracy. This accomplishment is based on an extensive dataset of nearly 9,594 collected meal photos, along with other associated data, such as post-meal walking steps.

Over a four-year period from 9/25/2019 to 10/29/2023, ***the author has authored over a dozen papers that delve into the intricate neurological communication model between the brain, stomach, liver, and pancreas through the central nervous system. These research papers specifically focus on two distinct food phases with identical nutritional ingredients: liquid eggs versus solid eggs.*** *Each paper utilizes varying dataset sizes, with the most recent paper featuring the largest dataset.* ***Remarkably, all these research papers consistently draw the same conclusion: the brain indeed communicates with the stomach, liver, and pancreas via the central nervous system regarding glucose and insulin levels, as evidenced in both peak PPG and averaged PPG.***

Notably, fasting plasma glucose (FPG) in the early morning serves as the baseline for our PPG formation and it also reflects the overall health status of our pancreatic beta cells. ***In this particular research, paper number 948, the author found that FPG levels for solid eggs and liquid eggs were nearly identical, at 97.57 mg/dL and 97.97 mg/dL, respectively.***

The author is a 28-year veteran of severe type 2 diabetes (T2D) who, since 12/8/2015, has effectively managed his T2D conditions without any diabetic medications, relying on a rigorous lifestyle management program exclusively. As a result, ***his daily glucose levels have significantly improved, decreasing from 280 mg/ dL (with an A1C of 11.4%) in 2010 to 100 mg/dL (with an A1C of 6.1%) in 2023.*** *A notable accomplishment in his glucose management is the application of a food consumption method derived from his own neurology research,* ***allowing him to "trick" his brain into lowering his PPG levels by choosing egg drop soups over pan-fried eggs or hardboiled eggs.***

This particular paper extends the author's ongoing research into the energies associated with both solid eggs and liquid eggs using spacedomain viscoelastic medicine theory (SD-VMT) methodology. It provides compelling evidence that aligns with the author's intuition that ***liquid meals possess a noticeable lower energy level, causing less internal organ damage and, consequently, a reduced risk of diseases.***



TD PPG of Solid Egg vs. Liquid Egg (5/1/15-10/29/23)
130
125
120
115
110
105
100
124 124 123 121 119 117 117 118 120 122
114 116 119
120
104 106 109 111 111 111 111 111 109 110 111 113 116
110
PPG Difference of (Solidegg - Liquid Egg):
0 min = 10 m,g/dL
60 min = 13 mg/dL
Average = 10 mg/dL
0 min 15 min 30 min 45 min 60 min 75 min 90 min 105 min 120 min 135 min 150 min 165 min 180 min Avg
Solid Liquid
SD-VMT of A1C of All meals vs. 330 Solid Egg & 220 Liquid Egg (5/1/15-10/29/23)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
-0.20
-0.25
6.80 6.90 7.00 7.10 7.20 7.30 7.40 7.50 7.60
SD-VMT Energy Ratio:
Solid Egg = 52%
Liquid Egg = 48%
Time-Zone Energy Distriobution:
0-60 min = 49%
75-=120 min = 51%
135-180 min = 0%
Solid Liquid

1. Introduction

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Over a four-year period from 9/25/2019 to 10/29/2023, ***the author has authored over a dozen papers that delve into the intricate neurological communication model between the brain, stomach, liver, and pancreas through the central nervous system. These research papers specifically focus on two distinct food phases with identical nutritional ingredients: liquid eggs versus solid eggs.*** Each paper utilizes varying dataset sizes, with the most recent paper featuring the largest dataset. ***Remarkably, all these research papers consistently draw the same conclusion: the brain indeed communicates with the stomach, liver, and pancreas via the central nervous system regarding glucose and insulin levels, as evidenced in both peak PPG and averaged PPG.***

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1.1. Biomedical information

The following sections contain excerpts and concise information drawn from multiple medical articles, which have been meticulously reviewed by the author of this paper. The author has adopted this approach as an alternative to including a conventional reference list at the end of this document, with the intention of optimizing his valuable research time. It is essential to clarify that these sections do not constitute part of the author's original contribution but have been included to aid the author in his future reviews and offer valuable insights to other readers with an interest in these subjects.

Pathophysiological explanations of neurological communication model between brain and stomach, liver, pancreas regrading postprandial plasma glucose (PPG) versus different physical states of the same food material, for example egg drop soup versus solid eggs, and different cooking methods:

The relationship between the brain, stomach, liver, pancreas, and postprandial plasma glucose levels involves a complex neuroendocrine system. When we consume food, especially carbohydrates, our body's systems work together to maintain blood glucose levels within a narrow range.

1. Stomach and Brain: The brain receives signals from the stomach to assess hunger and fullness. When we eat, the stomach stretches and sends signals to the brain, leading to the feeling of satiety and regulating food intake. When we consume liquid food like egg drop soup, it typically reaches the stomach in a more homogenized form, which can lead to quicker digestion. The brain receives signals about the volume of food consumed and the nutritional content. However, liquid foods may not trigger the same feeling of fullness as solid foods.
2. Liver: The liver plays a critical role in glucose regulation. It stores and releases glucose as needed to maintain blood glucose levels. After a meal, it can convert excess glucose into glycogen for storage. However, the liver's role in processing liquid vs. solid food is relatively similar. It continues to regulate glucose levels based on the nutrients absorbed into the bloodstream.
3. Pancreas: The pancreas secretes insulin and glucagon. After a meal, the pancreas releases insulin to help cells absorb glucose from the bloodstream, which lowers blood sugar levels. If blood glucose drops too low, the pancreas releases glucagon, which raises blood sugar. For some research scientists, they may think that with liquid foods, the absorption of glucose may happen more rapidly due to the predigestion of nutrients. ***However, the author of this paper has proven that both 334 liquid eggs and 322 solid eggs reached to the PPG peak around the same time instance, i.e. at 60-minutes after first-bit of meals.***
4. Postprandial Plasma Glucose: Postprandial plasma glucose (PPG) refers to blood sugar levels after a meal. It is influenced by the rate of glucose absorption and the body's insulin response. ***In the author of this research work, he has identified that the PPG response can vary somewhat based on the physical state of the food although their waveform similarity (correlation) is 68%. The major difference are amplitudes of two PPG curves.***

The communication model between the brain, stomach, liver, pancreas, and postprandial plasma glucose levels, when considering different physical states of food (e.g., liquid vs. solid), involves complex physiological processes. Here's an overview:

1. Egg Drop Soup: *Some people think that the liquid meals like egg drop soup may lead to a quicker spike in blood glucose levels because the carbohydrates are readily available for absorption. But, the author of this research paper has proven that, using 333 liquid egg meals and 322 solid egg meals data, the PPG spike time are at 60 minutes*

after firstbite of food, the same as the solid egg meals.
2. Solid Eggs: *Some people may think that the solid eggs are digested more slowly, leading to a slower and more sustained release of glucose into the bloodstream. They may even think that solid meal may have a lower glycemic index compared to a liquid meal. However, the author of this paper did not find sufficient proof to support this viewpoint.*

Regarding different cooking methods, they could affect postprandial glucose levels in the following way:
1. Frying: Foods cooked with excessive oil can lead to rapid absorption of fats, which may slow down glucose digestion and lead to a more gradual increase in blood glucose.
2. Boiling/Steaming: These methods tend to have a lower impact on postprandial glucose because they don't add extra fats or sugars to the food.
3. Grilling/Baking: Grilled or baked foods might have a more moderate impact on blood glucose compared to frying but can still cause glucose spikes depending on the ingredients.
4. Fiber and Cooking: ***Foods high in fiber, regardless of cooking method, tend to slow the absorption of glucose, resulting in a more stable postprandial glucose response.***

It's important to note that individual responses to different cooking methods can vary due to factors like genetics, meal composition, and overall health. Moreover, this complex interplay involves many other hormones and factors, and statistical data would require extensive research and clinical trials to provide meaningful insights.

For the latest statistics and research work on this topic, it is recommended that checking more medical journals, academic databases, and healthcare professionals may provide some clue regarding this subject.

2. Method

The author conducted an extensive study utilizing a continuous glucose monitor (CGM) device, collecting a dataset of 297,594 glucose data points spanning 3,099 days, averaging 96 daily measurements from May 5, 2018, to October 29, 2023. The author diligently monitored postprandial glucose (PPG) levels by taking measurements every 15 minutes for three hours after initiating each meal. Additionally, PPG values were also measured two hours postmeal using a finger-piercing method.

The primary focus of this study was to explore the intricate relationships between the nutritional content of foods, cooking methods, food material phases, and the resulting variations in glucose waveform patterns (PPG curves). Through meticulous observation, the author developed an innovative hypotheses regarding a communication model between the brain, stomach, liver, and pancreas via the central nervous system, specifically concerning the production amount, timing, and pattern of postprandial plasma glucose (PPG). These hypotheses were rigorously examined and validated using big data analytics, mathematical operations, and artificial intelligence tools, drawing from the extensive dataset encompassing both food and glucose.

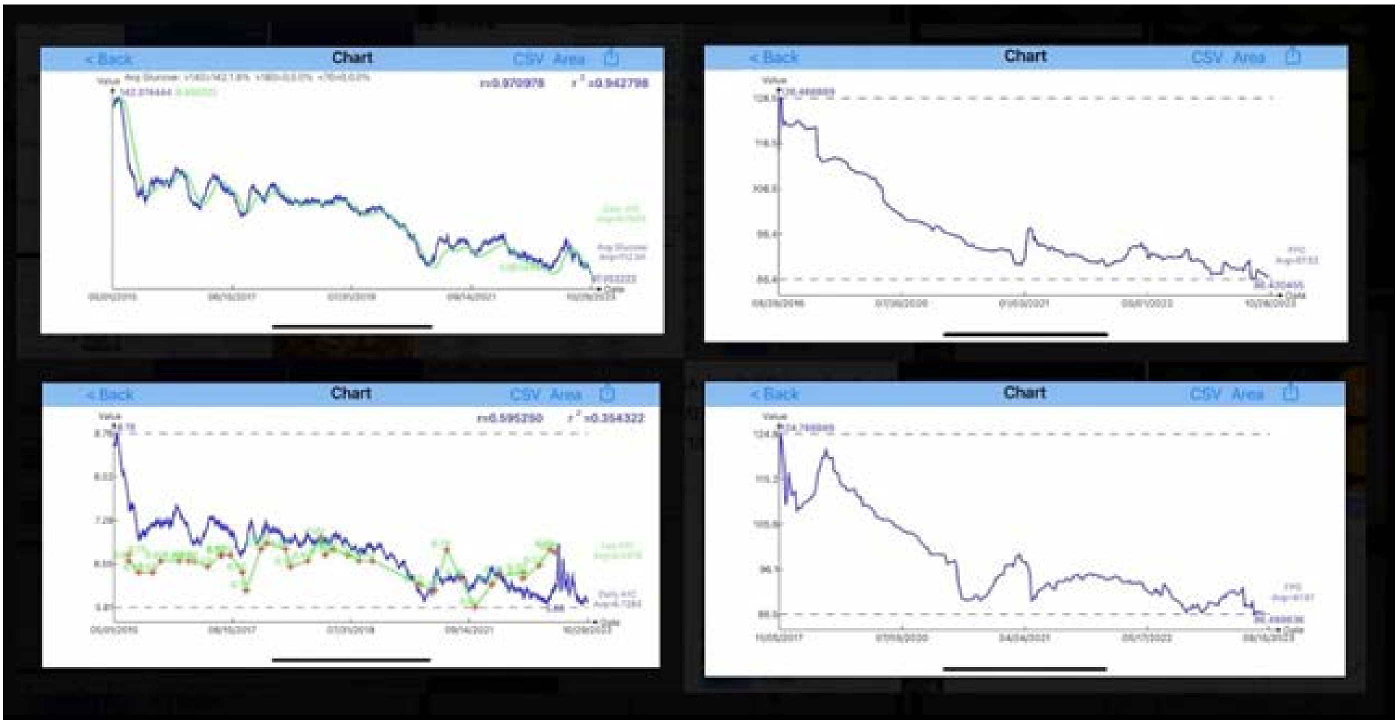
The author conducted personal experiments involving 655 distinct meals, encompassing a wide array of nutritional ingredients, food preparation techniques, and cooking methods, including soup-based (liquid) and pan-fried (solid) meals.

Within the soup-based liquid food category, the author included 333 liquid egg meals. In addition, he also has another category of 322 solid egg meals. It is important to note that ***in these experiments, "broth or soup" referred to pasty or clear soup without solid food chunks.***

In the pan-fried solid food category, the author examined 322 meals. On occasion, the author introduced some vegetables into his solid egg meals, yet it is worth mentioning that the vegetables were meticulously prepared, cut into specific sizes for pan-fried meals, while the soup-based vegetables were diced into tiny pieces and boiled to create a semi-clear or pasty-style broth. In this "single" food material studies, liquid and solid food shared identical nutritional ingredients and similar consumption quantities. In multiple food material meals, there might be some minor discrepancies in the total quantities of their ingredients.

3. Results

Figure 1 shows background data and cubes.



Egg Meals	100%	76%	7%	/ 120	/ 120	Strain Rate	Strain	Strs 1	Strs 2	Hgt 1	Hgt 2	Area 1	Area 2	Time-Zone	Pred.	Pred.	Pred.
10/30/23	All-A1C	Solid	Liquid	Solid	Liquid	A1C Rate	A1C	Solid	Liquid	Solid	Liquid	Solid	Liquid		Step 1	Step 2	VMT A1C
0 min	6.99	114	104	0.95	0.87	0.00	6.99	0.00	0.00	0.00	0.00	0.00	0.00	0-60 min	0.91	0.95	6.99
15 min	7.11	116	106	0.97	0.89	0.12	7.11	0.12	0.11	0.06	0.05	0.01	0.01	0.17	0.93	0.97	6.93
30 min	7.35	119	109	0.99	0.91	0.24	7.35	0.24	0.22	0.18	0.16	0.04	0.04	49%	0.95	0.99	7.10
45 min	7.53	124	111	1.03	0.92	0.18	7.53	0.19	0.17	0.21	0.19	0.04	0.03		0.98	1.02	7.31
60 min	7.55	124	111	1.04	0.93	0.02	7.55	0.02	0.02	0.10	0.09	0.00	0.00		0.98	1.03	7.34
75 min	7.40	123	111	1.03	0.92	-0.15	7.40	-0.15	-0.14	-0.07	-0.06	0.01	0.01	75-120 min	0.98	1.02	7.29
90 min	7.26	121	111	1.01	0.92	-0.14	7.26	-0.14	-0.13	-0.15	-0.13	0.02	0.02	0.18	0.97	1.01	7.22
105 min	7.07	119	111	0.99	0.92	-0.19	7.07	-0.19	-0.18	-0.17	-0.15	0.03	0.03	51%	0.96	1.00	7.15
120 min	6.91	117	109	0.97	0.91	-0.16	6.91	-0.16	-0.14	-0.17	-0.16	0.03	0.03		0.94	0.98	7.02
135 min	6.89	117	110	0.98	0.91	-0.02	6.89	-0.02	-0.02	-0.09	-0.08	0.00	0.00		0.95	0.99	7.05
150 min	6.93	118	111	0.99	0.93	0.04	6.93	0.04	0.04	0.01	0.01	0.00	0.00	135-180 min	0.96	1.00	7.14
165 min	6.99	120	113	1	0.95	0.06	6.99	0.06	0.06	0.05	0.05	0.00	0.00	0.00	0.97	1.02	7.26
180 min	7.01	122	116	1.02	0.97	0.02	7.01	0.02	0.02	0.04	0.04	0.00	0.00	0%	0.99	1.03	7.40
Avg	7.15	120	110	1	0.92	0	7.15	0	0	0	0	0.19	0.17	Accuracy	0.96	1.00	7.17
										SD-E:	0.35	52%	48%	99.7%		R =	50%

Figure 1: Background Data and Cubes

Figure 2 shows results from both time-domain and space-domain analyses.

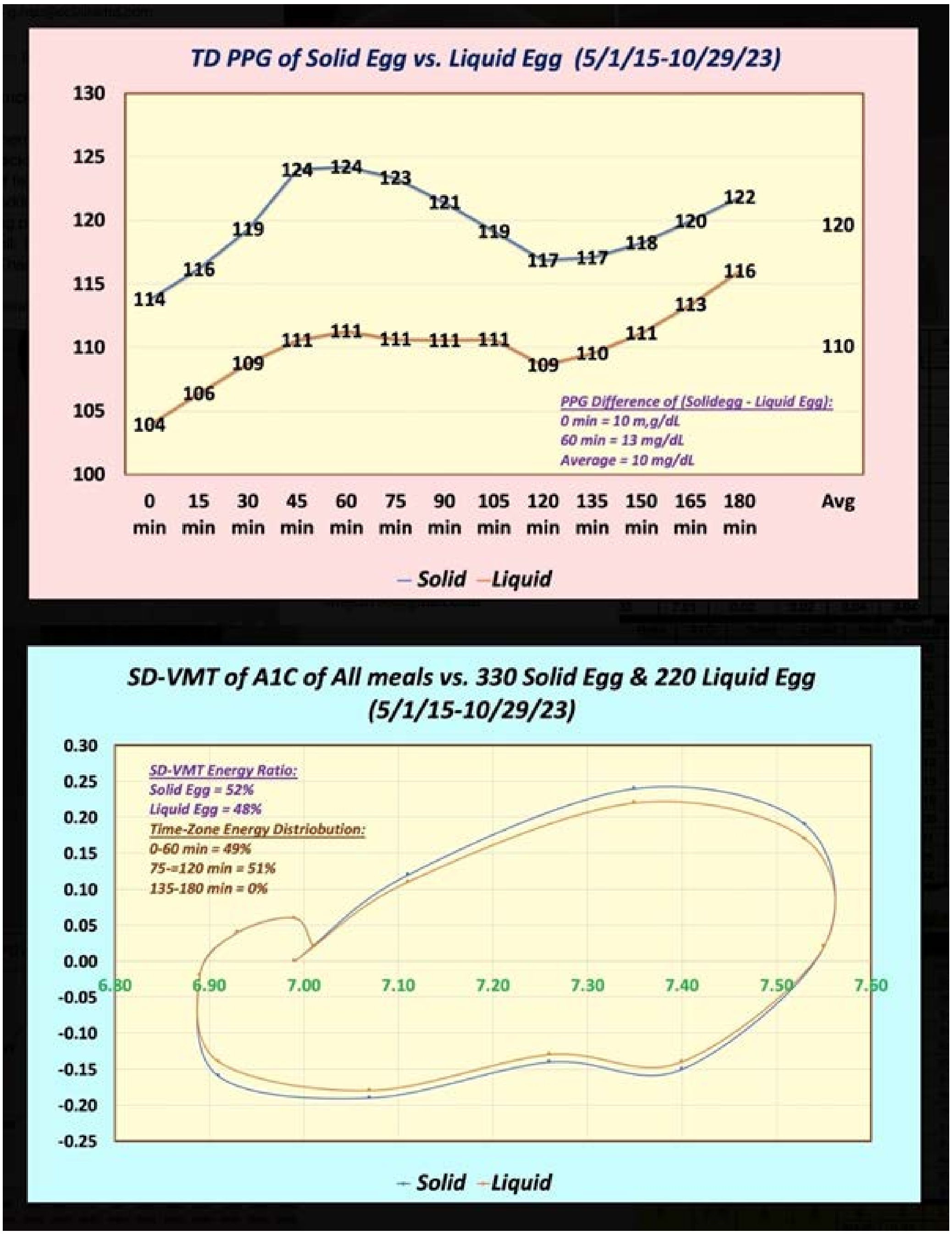


Figure 2: Results from Both Timedomain and Space-Domain Analyses

4. Conclusions

In summary, five key findings have emerged from this study:

1. The daily A1C curve and daily glucose curve exhibit an impressive correlation of 97%. Furthermore, the quarterly labtested A1C curve and the 99-days moving averaged daily A1C curve show a substantial correlation of 60%.
2. The averaged FPG in the early morning from 333 liquid egg meal days is 97.52 mg/dL, while the averaged FPG in the early morning from 322 solid egg meal days is 97.97 mg/dL. These two FPG values are almost identical, demonstrating that FPG's influences on his PPG data are virtually the same.
3. Variations in PPG at different time intervals are as follows: 10 mg/dL at the starting instant of 0 minutes, 13 mg/dL at the peak instant of 60 minutes, and 10 mg/dL for the averaged PPG over 180 minutes. The correlation between solid and liquid PPG curves is notably high at 68%.
4. The SD-VMT energy analysis reveals that solid eggs contribute 52% of the energy to A1C from the 655 total meals, while liquid eggs contribute 48%. This 4% energy difference has a discernible impact on A1C levels, for example, A1C differentiating between 7% and 7.3%.
5. The SD-VMT time-zone energy distribution indicates that all infused energy between 0-60 minutes (49%) is completely diffused (51%) between 75-120 minutes, a result of post-meal walking exercise. Notably, the averaged post-meal walking steps amount to 4,191 steps for 322 solid eggs is very close to 3,980

steps for 333 liquid eggs. Consequently, there is no remaining energy associated with the time-zone of 135-180 minutes (~0%).

The author's Hypothesis

Over the course of the past nine years, spanning from 2015 to 2023, the author has meticulously gathered knowledge encompassing both internal medicine and food nutrition. This comprehensive understanding has illuminated the critical role of varying carbohydrate and sugar levels in food intake on glucose levels. However, the author has been driven to seek an explanation for the observed disparities between higher postprandial glucose (PPG) values from solid foods and lower PPG values from liquid foods.

In this quest for clarity, the author revisits fundamental physics concepts acquired during his junior high school education, recognizing the three primary phases of matter: solid, liquid, and gas. Within the context of this meal study, the author focuses on two phases - the liquid phase, exemplified by egg drop soups, and the solid phase, illustrated by pan-fried eggs or hard-boiled eggs.

The author has also synthesized valuable insights from nine years of his dedicated biomedical research. Firstly, he unveils a discovery that approximately 70% of our energy intake is attributed to our brain and nervous system, challenging the conventional belief that the heart is the paramount energy consumer. Secondly, the author underscores the unique role of the brain as the sole internal organ endowed with functions such as sensory perception, situational judgment, information processing, decision-making, and the issuance of commands, akin to the central processing unit (CPU) of a computer system. Lastly, the author emphasizes the harmonious synergy and intricate interconnection of all internal organs, operating under the exclusive directives of our brain.

Furthermore, in one of his past experiments, the author delves into a specialized endeavor, involving the placement of an IC chip on the skin of a human leg. This experiment unveils the electronic flow and signal transmission through the nervous system, effectively showcasing the remarkable capabilities of our brain and nervous system.

The author's research leads to an intriguing revelation: in the early morning upon waking, before breakfast, neither food nor exercise significantly impacts our glucose levels. However, our brain is acutely aware of our morning body weight and communicates this information to the liver via the central nervous system. This communication directs the precise production of fasting plasma glucose (FPG) after waking up. This elucidates the reason for the average 10 to 15 mg/dL FPG surge between the moment of awakening and breakfast consumption.

Regarding postprandial glucose (PPG), the author astutely recognizes that glucose is generated by the liver from glycogen, rather than being "directly transformed or converted" from food, a misconception occasionally propagated by some nutritionists and internal physicians. Glycogen serves as the substance stored in bodily tissues for carbohydrate storage. Initially, the liver breaks down dietary carbohydrates and synthesizes glucose. When the body doesn't require immediate energy from glucose, it is stored in the liver and muscles as glycogen.

The author's perspective on this matter draws from his academic foundation and professional training in mathematics, physics, engineering, and computer science. He perceives the liver as an operational system, encompassing a "stimulator" (food as input), a "command center" (the brain as the central processing unit), and a "feedback system" (glucose as the output). In this context, glucose isn't directly "converted" from food; instead, it is "produced, stored, and released" by the liver. Nevertheless, the liver depends on food as an "energy source" for its functions and as the "raw material" input for glucose production, akin to coal for a train's steam engine.

Building upon the earlier discussed knowledge and his distinctive engineering interpretation, the author postulates a hypothesis regarding glucose production by the liver. This hypothesis revolves around the notion that differences in postprandial glucose (PPG) production, both in quantity and timing, are dictated by the specific physical phase of the meal, categorized as either "liquid" or "solid." The final physical phase of a meal directly shapes a patient's PPG characteristics, encompassing the height of the glucose peak, the degree of glucose fluctuations, and the form of the resultant glucose curve.

Upon the introduction of a particular food type into the entry portion of our gastrointestinal system, the stomach promptly dispatches signals via the central nervous system to apprise the brain of the food's arrival and its physical phase, whether liquid or solid. Subsequently, the brain processes these two input signals, alongside other pertinent biochemical data, makes determinations, and issues operational directives to the liver regarding the amount of glucose to be generated and the timeframe for its production. This information processing and directive issuance process is notably "nonlinear" and "dynamic" owing to the intricate and ever-evolving biochemical conditions of food ingredients and biochemical reactions within the human body. This intricate complexity accounts for the variability in the timing of glucose peaks based on the physical phase of the food, such as liquid vs. solid, and even within subcategories like eggs vs. vegetables. Conventional nutrition specialists and some diabetes doctors often struggle to convincingly and lucidly elucidate these observations.

Timing plays a significant role in this process. The author observed from his collected over 297,504 glucose data points collected over the past 9 years that the body typically takes about 10-15 minutes to reach its glucose peak after consuming highsugar content liquid food, about 30-60 minutes for liquid food, and about 45-75 minutes for solid food contains carbohydrates. ***In average, PPG usually reaches to its peak around 60 minutes after first-bite of meal.*** The 15 minutes delay in reaching the glucose peak for solid food may be attributed to the digestive process.

Simultaneously, the brain communicates with the pancreas, instructing it on how much insulin to produce to counterbalance the excessive glucose generated by the liver. However, for diabetes patients with severely damaged pancreatic beta cells, their insulin production capabilities are impaired. As a result, the most effective approach for these patients is to find practical ways to reduce the production of glucose, for example, insulin shots.

This hypothesis explains the author's math-physical perspective on how the brain communicates with the stomach and liver via the central nervous system regarding the quantity, timing, and waveform pattern of PPG during either a 180-minute or 120-minute period after the first bite of a meal. ***Lower PPG values and flatter curve patterns from liquid-based meals are associated with the physical phase of the food, akin to drinking tea or water, which does not trigger the brain to increase glucose production.***

It is important to note that type 2 diabetes patients should consistently avoid foods high in carbohydrates, such as starchy grains, flours, corn, and potatoes, as well as foods with high sugar content, like sweetened cakes, ice creams, or sugary beverages.

Hence, this discovery offers an opportunity to "trick" the brain into producing a "lower amount of glucose" for diabetes patients when they consume a soup-based meal, even if the nutritional ingredients are the same as in solid food. This emphasizes the influential role of the brain in managing glucose levels.

Regarding the author's earlier discovery from March 2017 regarding relationships between FPG and body weight, ***it is clear that the brain has a profound influence as it knows the morning body weight and dictates to the liver the appropriate amount of FPG to be produced. Once again, it highlights the power of the brain in regulating glucose levels, both PPG and FPG.***

The author has employed the GH-Method: math-physical medicine (MPM approach) to scrutinize the glucose production process in Type 2 Diabetes (T2D) patients, with a specific focus on the brain and nervous system's role. This approach has led to the formulation of a hypothesis proposing the pivotal role of the brain in glucose regulation. Should this hypothesis stand valid, it offers the intriguing possibility of "tricking" the brain into reducing postmeal glucose production without compromising vital food ingredients or nutritional balance. Consequently, T2D patients may have the potential to adapt certain cooking methods to lower both their peak postprandial glucose (PPG) values and their average PPG levels.

Furthermore, by recognizing the robust correlation and direct linkage between fasting plasma glucose (FPG) and body weight, it becomes feasible to have an effective control over FPG levels as well. This, in turn, enables more efficient management of a T2D patient's overall glucose levels, encompassing FPG and post-meal PPG values.

The author's objective is to disseminate his research findings among fellow medical research scientists, inviting their insights to offer enhanced interpretations, precise explanations, or supplementary justifications for the broader medical and healthcare community. This collaborative endeavor may encompass the utilization of both the GH-Method (MPM approach) and traditional biomedical research methodologies, such as pathophysiology or biochemical medicine (BCM approach). Together, these two different approaches aim to foster a more comprehensive understanding of diabetes management and potentially yield innovative solutions for T2D patients.