The GH-Method

Viscoelastic Medicine Theory (VMT #285): Pathophysiological Illustrations of Communication between Brain and Internal Organs Including Stomach, Liver and Pancreas Using all of 9,272 Meals Data versus 4 Egg Meals between 5/1/2015 and 7/11/2023, and a Quantitative SD-VMT Energy Analysis of GH-Method: Math-Physical Medicine (No. 885)

Gerald C. Hsu*

eclaireMD Foundation, USA

Abstract

The author-initiated research on neurology in October 2019 and published his first paper on this subject as Paper No. 130. The current article, Paper No. 885 (VMT #285), written on 7/12/2023, serves as an updated version of his previous paper, Paper No. 864 (VMT#265), written on 6/12/2023. The analysis in both papers, utilizing the SD-VMT energy model, exhibits a high level of similarity, with a distinction being the selected time period differing by one month. Recently, he has shifted his focus towards studying the pathology and physiology of the neural communication system. Therefore, in this article (No. 885), he provides more extensive explanations of the pathophysiological aspects pertaining to neurological communication between the brain and organs. To investigate the communication between brain and stomach, he has conducted personal experiments involving egg-based meals. These experiments place emphasis on the message transmission related to food arrival and food type, with various instructions from the brain regarding glucose production by the liver and insulin hormone production by pancreatic beta cells. Over an 8-year span, from 5/1/2015 to 7/11/2023, he has examined neurological and pathophysiological behaviors by consuming a total of 632 egg-only meals and 2,183 all egg-based meals (often mixed with vegetables). In summary, there are 5 key findings: 1. Comparison of solid eggs versus liquid eggs showed that peak PPG was 112% and averaged PPG was 109%. Therefore, consuming egg drop soup would result in a 9-14 mg/dL lower PPG value and with the same nutritional value. 2. Results from the SD-VMT energy model showed that egg soups had a PPG energy of 23.5%, solid eggs had 25.9%, egg-only meals had 24.7%, and total egg meals had 26.0%. This demonstrates that consuming egg drop soup would result in 10% less PPG energy in his body. 3. Time-zone analysis revealed that 50% of his total energy was accumulated in the first hour after eating, 47% of energy dissipated through post-meal walking (~4,000 steps) in the second hour, and only 3% was residual energy that could potentially cause damage to internal organs. 4. Overall, the energy levels of all egg meals and solid egg meals were similar and higher than egg-only meals which was further higher than the energy of egg drop soups. This suggests that liquid egg soup meals offer the best benefit for diabetes control. 5. The author suggests that other diabetes patients could try this cooking method or eating style of egg drop soup as a way to deceive the brain into producing less glucose while still maintaining the same nutritional value of meals.

Keywords: Viscoelastic; Viscoplastic; Glucose; Meals

Abbreviations: MI: metabolism index; T2D: type 2 diabetes; PPG: postprandial plasma glucose; FPG: fasting plasma glucose; SD: space-domain

Available online: 02 January 2024

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

1. INTRODUCTION

The author-initiated research on neurology in October 2019 and published his first paper on this subject as Paper No. 130. The current article, Paper No. 885 (VMT #285), written on 7/12/2023, serves as an updated version of his previous paper, Paper No. 864 (VMT#265), written on 6/12/2023. The analysis in both papers, utilizing the SD-VMT energy model, exhibits a high level of similarity, with a distinction being the selected time period differing by one month.

Recently, he has shifted his focus towards studying the pathology and physiology of the neural communication system. Therefore, in this article (No. 885), he provides more extensive explanations of the pathophysiological aspects pertaining to neurological communication between the brain and organs.

To investigate the communication between brain and stomach, he has conducted personal experiments involving egg-based meals. These experiments place emphasis on the message transmission related to food arrival and food type, with various instructions from the brain regarding glucose production by the liver and insulin hormone production by pancreatic beta cells. Over an 8-year span, from 5/1/2015 to 7/11/2023, he has examined neurological and pathophysiological behaviors by consuming a total of 632 egg-only meals and 2,183 all egg-based meals (often mixed with vegetables).

1.1 Pathophysiological interpretation

Communication between brain and stomach

The communication between the brain and the stomach, often referred to as the "gut-brain axis," involves complex bidirectional communication pathways that include neural, hormonal, and immunological signals. This relationship plays a crucial role in maintaining homeostasis and is believed to be a critical factor in understanding and treating a variety of medical conditions, ranging from gastrointestinal disorders to mental health conditions.

Here's a simplified pathophysiological illustration:

1. Neural pathway: The primary neural connection between the brain and the stomach is through the vagus nerve, which is a part of the autonomic nervous system. The vagus nerve conveys signals in both directions – from the brain to the stomach (efferent signaling) and from the stomach to the brain (afferent signaling). When the brain perceives a stimulus like stress, it can signal the stomach via the efferent fibers to alter motility, secretion, or other functions. Conversely, the stomach can signal to the brain about its status or events like stretching or inflammation via afferent fibers. This can influence brain functions, leading to sensations of hunger, satiety, nausea, or discomfort.

2. Hormonal pathway: Various hormones are involved in the brain-stomach communication. For example, ghrelin is a hormone produced in the stomach that signals the brain to stimulate hunger. After eating, cells in the stomach and small intestine produce hormones like cholecystokinin (CCK), peptide YY (PYY), and glucagon-like peptide-1 (GLP-1) that signal satiety to the brain. Serotonin, a neurotransmitter predominantly found in the gut, also plays a crucial role in regulating mood and gut function.

3. Immunological pathway: The immune system also contributes to the gut-brain axis. The gut is home to a vast number of microbes collectively known as the gut microbiota, which interact with the local immune system and can produce various metabolites and neurotransmitters. These can enter the circulation and influence the brain. Conversely, the brain can influence the immune response and gut microbiota through the neuroendocrine system.

4. Enteric nervous system (ENS): This is a complex system of neurons in the walls of the gastrointestinal tract, often referred to as the "second brain." The ENS can operate autonomously but is also influenced by the central nervous system (CNS) via the sympathetic and parasympathetic pathways. The ENS plays a vital role in controlling gut motility, secretion, blood flow, and nutrient absorption.

The communication between the brain and stomach is vital for maintaining the proper functioning of the digestive system. This communication process occurs through a complex network of nerve cells, hormones, and chemical messengers.

The nervous system is responsible for transmitting signals between the brain and the stomach. It consists of two main components: the central nervous system (CNS) and the enteric nervous system (ENS). The CNS is made up of the brain and spinal cord, while the ENS is a complex network of neurons that resides in the wall of the gastrointestinal tract.

The ENS is also known as the "second brain" because it can function independently of the CNS. It regulates various digestive processes, such as the release of enzymes and the movement of food through the intestines. The ENS communicates with the CNS through the vagus nerve, which is responsible for controlling the parasympathetic nervous system.

Hormones also play a critical role in the communication between the brain and stomach. Hormones such as gastrin, secretin, and cholecystokinin are released by cells in the stomach and intestines and signal the brain to regulate digestive processes. For example, gastrin stimulates the release of stomach acid and enzymes, while cholecystokinin signals the gallbladder to release bile.

Finally, chemical messengers such as neurotransmitters are involved in the communication between the brain and stomach. The neurotransmitters serotonin and dopamine are found in both the brain and the gastrointestinal tract and play a role in controlling digestion.

In summary, the communication between the brain and stomach is a complex process involving the nervous system, hormones, and chemical messengers. This communication network helps to regulate various digestive processes and maintain proper functioning of the digestive system.

In recent years, researchers have been increasingly interested in how the gut-brain axis might be implicated in various diseases and conditions. For instance, the gut-brain axis is thought to play a role in functional gastrointestinal disorders like irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD), but also in neurological and psychiatric conditions like Parkinson's disease, Alzheimer's disease, depression, and anxiety. The use of probiotics (beneficial bacteria), prebiotics (compounds that foster beneficial bacteria), or certain dietary interventions might help modulate the gut microbiota and, through that, potentially influence the gut-brain communication. However, research in this field is still in its early stages, and more studies are needed to fully understand the potential of these interventions.

1.2 Pathophysiological interpretations of neurological communication between brain and stomach regarding food arrival

The neurological communication between the brain and stomach is essential for the initiation of various digestive processes as soon as food arrives in the stomach. The pathophysiological interpretations of this communication process can help explain the underlying mechanisms involved in digestion and the possible implications for certain gastrointestinal disorders.

When food enters the stomach, the stretch receptors in the stomach walls detect the increase in volume and send signals to the brain, triggering the release of several hormones, including gastrin, ghrelin, and motilin. Gastrin stimulates the production of stomach acid and promotes the contraction of stomach muscles to mix and break down the food. Ghrelin regulates appetite and induces hunger, while motilin is involved in the movement of food through the gastrointestinal tract.

In some gastrointestinal disorders such as gastroparesis, a condition in which the muscles of the stomach are impaired, leading to slow digestion, the communication between the brain and stomach is disrupted. This disruption can lead to delayed gastric emptying, which can cause symptoms such as nausea, vomiting, and bloating. In gastroparesis, the signals for stomach emptying may not be transmitted properly, leading to a delay in food transit and symptoms.

Another example is irritable bowel syndrome (IBS), a functional gastrointestinal disorder that affects the communication between the brain and the digestive system. In IBS, the brain and gut may not communicate correctly, leading to abnormalities in the digestive process and resulting in symptoms such as abdominal pain, bloating, constipation, and diarrhea.

In summary, the neurological communication between the brain and stomach plays a critical role in initiating and regulating various digestive processes as soon as food arrives in the stomach. The disruption of this communication can lead to various gastrointestinal disorders, which can result in symptoms such as nausea, vomiting, bloating, and abdominal pain. Understanding the pathophysiological interpretations of this communication process can help identify potential targets for the therapies for various gastrointestinal disorders.

1.3 Pathophysiological interpretations of neurological communication between brain and stomach regarding the arrival of different food type

The neurological communication between the brain and stomach in response to different food types is important in regulating digestive processes, such as the release of digestive enzymes and hormones. The pathophysiological interpretations of this communication process can help explain the underlying mechanisms involved in digestive disorders that may result from disruptions in this communication.

Different types of food elicit different responses in the digestive system, depending on their nutrient content and physical properties. For example, protein and fat-rich foods can lead to the release of hormones like cholecystokinin and gastrin, which stimulate the secretion of enzymes and acids that break down these nutrients. Conversely, carbohydrate-rich foods can cause the release of hormones like insulin, which regulates the uptake of glucose by the body's cells.

Disruptions in the neurological communication between the brain and stomach can lead to various digestive disorders related to food types. For example, lactose intolerance is a condition where individuals have difficulty digesting lactose, a sugar found in milk and dairy products, due to the deficiency of the enzyme lactase. As a result, undigested lactose can remain in the intestine, causing bloating, gas, and diarrhea.

Celiac disease is another disorder where the immune system attacks the lining of the small intestine in response to the ingestion of gluten, a protein found in wheat, barley, and rye. This results in inflammation and damage to the small intestine, leading to symptoms like abdominal pain, diarrhea, and malnutrition. The neurological communication between the brain and stomach plays a role in triggering and regulating the immune response to gluten in celiac disease.

In summary, the neurological communication between the brain and stomach in response to different food types is critical in initiating and regulating various digestive processes. Disruptions in this communication can lead to disorders related to specific food types, such as lactose intolerance and celiac disease. Understanding the pathophysiological interpretations of this communication can help identify potential targets for therapies to treat digestive disorders.

The stomach and other parts of the digestive system play a crucial role in sensing the arrival and type of food and communicating this information to the brain and other organs. Here's a simplified explanation:

1. Food detection: Specialized cells in the stomach and intestines, known as enteroendocrine cells, can detect various characteristics of ingested food. For example, they can sense the presence of carbohydrates, proteins, and fats in the chyme (the mixture of food and stomach juices).

2. Hormonal signaling: Once these cells detect the type of nutrients, they secrete hormones that communicate this information to the rest of the body. For instance, in response to fats and proteins, they release cholecystokinin (CCK) which signals the gallbladder to release bile and the pancreas to release digestive enzymes. Similarly, in response to carbohydrates, they release incretins like glucose-dependent insulinotropic peptide (GIP) and glucagon-like peptide-1 (GLP-1).

3. Brain communication: These hormones not only regulate digestion but also communicate with the brain via the bloodstream. For example, GLP-1 and GIP enhance feelings of satiety and slow gastric emptying. This gives the body more time to process the nutrients and reduces food intake.

4. Glucose production and insulin release: The hormones also communicate with the liver and pancreas. When blood sugar levels are low, the liver converts stored glycogen into glucose under the influence of the hormone glucagon. After eating, when blood sugar levels rise, the pancreas releases insulin in response to the incretins and directly to high glucose levels. Insulin helps cells in the body absorb glucose from the bloodstream.

5. Role of nervous system: In addition to these hormonal signals, the enteric nervous system in the gut wall and the vagus nerve (part of the parasympathetic nervous system) also play a role in sensing food and communicating with the brain and other organs.

So, in a sense, the stomach and intestines do "inform" the brain and other organs about the arrival and type of food. However, this is a complex and highly coordinated process involving a multitude of hormones and neural signals. Understanding these mechanisms can help in the management of various disorders, such as diabetes, obesity, and other metabolic conditions.

Let’s extend above explanation on how the brain communicates with the stomach and related organs in the context of different types of food intake and subsequent metabolic processes in the following sections.

In general, the brain-stomach communication involves a complex system of hormonal signals, neural pathways, and feedback mechanisms to ensure efficient digestion and nutrient absorption. This complexity increases when we consider the effects of different types of food (solid versus liquid, or different macronutrient compositions).

1. Solid vs liquid food: The physical and chemical properties of food impact how it is processed. Solid foods typically require more mechanical breakdown in the stomach, which stimulates greater gastric acid secretion. Solid foods also spend more time in the stomach, leading to a slower and more sustained release of nutrients into the small intestine. Liquid foods, on the other hand, move through the stomach more quickly, leading to a rapid spike in nutrient absorption.

2. Macronutrient composition: The type of nutrients (carbohydrates, proteins, and fats) in the food also impacts digestion and subsequent hormonal responses. Carbohydrates, particularly simple sugars, are quickly absorbed, leading to a rapid rise in blood glucose levels and subsequent insulin release from the pancreas. Fats and proteins stimulate the release of other hormones like CCK and PYY that slow gastric emptying and promote satiety.

3. Brain's role in metabolic regulation: The brain integrates these various signals to regulate both immediate and long-term energy needs. For example, in response to rising blood glucose levels, the brain signals the pancreas to secrete insulin, promoting glucose uptake into cells. Conversely, when blood glucose levels fall, the brain signals the liver to produce glucose.

4. Feedback mechanisms: There are several feedback mechanisms in place to regulate these processes. For instance, as nutrients are absorbed and blood glucose levels rise, this signals the brain to reduce feelings of hunger. Conversely, when nutrient levels are low, this stimulates feelings of hunger.

5. Liver and pancreas response: Both the liver and pancreas play vital roles in this process. The liver regulates glucose storage and release, ensuring stable blood glucose levels. The pancreas, on the other hand, regulates the production of insulin and glucagon – hormones that control cellular glucose uptake and liver glucose production, respectively.

This communication system between the brain, stomach, liver, and pancreas ensures our bodies have the energy they need to function while maintaining metabolic balance. Any disruption in this system could lead to metabolic disorders such as diabetes or obesity. This is why understanding the complex relationships between food intake, digestion, and metabolic regulation is crucial for promoting health and preventing disease.

This particular article:

This article discusses different glucose outcomes from egg meals via two different cooking methods. The author has collected his glucose data from 312 solid egg meals (pan-fried egg or hard-broiled egg) and 320 liquid egg meals (egg drop soup). Although the averaged carbohydrates intake amounts are identical (around 4 grams to 5 grams for 2 large eggs) for these two egg meals, even the averaged post-meal exercise levels (around 4,000 walking steps) are almost identical. Therefore, from viewpoints of both food nutrition and endocrinology, their post-meal glucose outcomes should be either the same or at least very close to each other. But they are not! (The author discovered this strange biophysical phenomenon in mid-2019).

This strange biophysical observation can be interpreted via neurological explanations. His interpretation in 2019 was described as follows: "When food arrives at stomach, its cells detect food arrival and physical state of food (either solid or liquid) and then inform the brain cell via central neural system. The brain cells then make a judgement that liquid food is similar to drinking water or tea, and therefore inform liver to produce less amount of glucose and pancreas to release less amount of insulin to regulate the glucose."

From this study, the author has observed that these following 4 meal types as the input variables of his space-domain viscoelastic energy analysis.

First, the 320 liquid egg soups type produces a peak glucose at 112 mg/dL (around 60 minutes) with an averaged glucose of 110 mg/dL. It has an averaged 4.5 grams of carbohydrates and sugar amount and 4,013 averaged post-meal walking steps.

Second, the 312 solid egg meals type produces a peak glucose at 125 mg/dL (around 60-minutes), with an averaged glucose of 121 mg/dL. It has an averaged 5.1 grams of carbohydrates and sugar amount and 4,218 averaged post-meal walking steps.

It should be noted that between these two meal groups, the peak glucose (around 60-minutes) difference is 13 mg/dL and averaged glucose (over 3 hours) difference is 10 mg/dL. These glucose differences are direct results from communication between brain and stomach via neurological system.

Third, the author collected a group of 642 combined meals which contains eggs only (both liquid and solid eggs). This egg only meals type produces a peak glucose at 118 mg/dL (around 75-minutes), with an averaged glucose of 115 mg/dL. It has an averaged 4.8 grams of carbohydrates and sugar amount and 4,114 averaged post-meal walking steps.

Fourth, the author further collected a group of 2,183 meals which contains eggs and other vegetables or meats such as onion, cabbage, pork, or ham. This mixed egg meals type produces a peak glucose at 126 mg/dL (around 60-minutes), with an averaged glucose of 120 mg/dL. It has a higher averaged 9.5 grams of carbohydrates and sugar amount and 4,271 averaged post-meal walking steps.

His selected single output variable is a group of 9,152 meals over a period from Y2015 to Y2023 which contains all of different food ingredients. This overall meals group produces a peak glucose at 129 mg/dL (around 60-minutes), with an averaged glucose of 123 mg/dL. It has a much higher averaged 13.6 grams of carbohydrates and sugar amount and 4,214 averaged post-meal walking steps.

In the body of this article, at first, the author describes the communication and relationship between his brain and his stomach via his nerve system using his collected 5 PPG waveforms (1 output of all meals and 4 inputs of soup egg meal, solid egg meal, egg only meals, and all meals with eggs) using illustrations via pathology and physiology of biomedicine (a qualitative description approach). Then, he applies energy models in space-domain (SD) to provide a quantitative energy contribution levels (i.e. degree of influences) from each of these 4 egg meal PPG components on his PPG from a total of 9,272 meals.

Furthermore, he calculated his 3 time-zone energies in his SD-VMT analysis results, i.e. first hour (0-60 minutes), second hour (75-120 minutes), third hour (135-180 minutes).

2. METHODS

2.1 MPM background

To learn more about his developed GH-Method: math-physical medicine (MPM) methodology, readers can read the following three papers selected from his published 760+ papers.

The first paper, No. 386 describes his MPM methodology in a general conceptual format. The second paper, No. 387 outlines the history of his personalized diabetes research, various application tools, and the differences between the biochemical medicine (BCM) approach versus the MPM approach. The third paper, No. 397 depicts a general flow diagram containing ~10 key MPM research methods and different tools.

2.2 The author's diabetes history

The author was a severe T2D patient since 1995. He weighed 220 lb. (100 kg) at that time. By 2010, he still weighed 198 lb. with average daily glucose of 250 mg/dL (HbA1C at 10%). During that year, his triglycerides reached 1161 (high risk for CVD and stroke) and his albumin-creatinine ratio (ACR) at 116 (high risk for chronic kidney disease). He also suffered from five cardiac episodes within a decade. In 2010, three independent physicians warned him regarding the need for kidney dialysis treatment and the future high risk of dying from his severe diabetic complications.

In 2010, he decided to self-study endocrinology with an emphasis on diabetes and food nutrition. He spent the entire year of 2014 developing a metabolism index (MI) mathematical model. During 2015 and 2016, he developed four mathematical prediction models related to diabetes conditions: weight, PPG, fasting plasma glucose (FPG), and HbA1C (A1C). Through using his developed mathematical metabolism index (MI) model and the other four glucose prediction tools, by the end of 2016, his weight was reduced from 220 lb. (100 kg) to 176 lb. (89 kg), waistline from 44 inches (112 cm) to 33 inches (84 cm), average finger-piercing glucose from 250 mg/dL to 120 mg/dL, and A1C from 10% to ~6.5%. One of his major accomplishments is that he has no longer taken any diabetes-related medications since 12/8/2015.

In 2017, he achieved excellent results on all fronts, especially his glucose control. However, during the pre-COVID period, including both 2018 and 2019, he traveled to ~50 international cities to attend 65+ medical conferences and made ~120 oral presentations. This hectic schedule inflicted damage to his diabetes control caused by stress, dining out frequently, post-meal exercise disruption, and jet lag, along with the overall negative metabolic impact from the irregular life patterns; therefore, his glucose control was somewhat affected during the two-year traveling period of 2018-2019.

He started his COVID-19 self-quarantined life on 1/19/2020. By 10/16/2022, his weight was further reduced to ~164 lb. (BMI 24.22) and his A1C was at 6.0% without any medication intervention or insulin injection. In fact, with the special COVID-19 quarantine lifestyle since early 2020, not only has he written and published ~500 new research articles in various medical and engineering journals, but he has also achieved his best health conditions for the past 27 years. These achievements have resulted from his non-traveling, low-stress, and regular daily life routines. Of course, his in-depth knowledge of chronic diseases, sufficient practical lifestyle management experiences, and his developed high-tech tools have also contributed to his excellent health improvements.

On 5/5/2018, he applied a continuous glucose monitoring (CGM) sensor device on his upper arm and checks his glucose measurements every 5 minutes for a total of 288 times each day. Furthermore, he extracted the 5-minute intervals from every 15-minute interval for a total of 96 glucose data each day stored in his computer software.

Through the author's medical research work of over 40,000 hours and reading over 4,000 published medical papers online in the past 13 years, he discovered and became convinced that good life habits of not smoking, moderate or no alcohol intake, avoiding illicit drugs; along with eating the right food with well-balanced nutrition, persistent exercise, having a sufficient and good quality of sleep, reducing all kinds of unnecessary stress, maintaining a regular daily life routine contribute to the risk reduction of having many diseases, including

CVD, stroke, kidney problems, micro blood vessels issues, peripheral nervous system problems, and even cancers and dementia. In addition, a long-term healthy lifestyle can even "repair" some damaged internal organs, with different required time-length depending on the particular organ's cell lifespan. For example, he has "self-repaired" about 35% of his damaged pancreatic beta cells during the past 10 years.

2.3 Energy theory

The human body and organs have around 37 trillion live cells which are composed of different organic cells that require energy infusion from glucose carried by red blood cells, and energy consumption from labor-work or exercise. When the residual energy (resulting from the plastic glucose scenario) is stored inside our bodies, it will cause different degrees of damage or influence to many of our internal organs.

According to physics, energies associated with the glucose waves are proportional to the square of the glucose amplitude. The residual energies from elevated glucoses are circulating inside the body via blood vessels which then impact all of the internal organs to cause different degrees of damage or influence, e.g. diabetic complications. Elevated glucose (hyperglycemia) causes damage to the structural integrity of blood vessels. When it combines with both hypertension (rupture of arteries) and hyperlipidemia (blockage of arteries), CVD or Stroke happens. Similarly, many other deadly diseases could result from these excessive energies which would finally shorten our lifespan. For example, the combination of hyperglycemia and hypertension would cause micro-blood vessel leakage in kidney systems which is one of the major causes of CKD.

The author then applied Fast Fourier Transform (FFT) operations to convert the input wave from a time domain into a frequency domain. The y-axis amplitude values in the frequency domain indicate the proportional energy levels associated with each different frequency component of input occurrence. Both output symptom value (i.e. strain amplitude in the time domain) and output symptom fluctuation rate (i.e. the strain rate and strain frequency) are influencing the energy level (i.e. the Y-amplitude in the frequency domain).

Many people live a sedentary lifestyle and lack sufficient exercise to burn off the energy influx which causes them to become overweight or obese. Being overweight and having obesity leads to a variety of chronic diseases, particularly diabetes. In addition, many types of processed food add unnecessary ingredients and harmful chemicals that are toxic to the bodies, which lead to the development of many other deadly diseases, such as cancers. For example, ~85% of worldwide diabetes patients are overweight, and ~75% of patients with cardiac illnesses or surgeries have diabetes conditions.

In engineering analysis, when the load is applied to the structure, it bends or twists, i.e. deforms; however, when the load is removed, it will either be restored to its original shape (i.e, elastic case) or remain in a deformed shape (i.e. plastic case). In a biomedical system, the glucose level will increase after eating carbohydrates or sugar from food; therefore, carbohydrates and sugar function as the energy supply. After having labor work or exercise, the glucose level will decrease. As a result, the exercise burns off the energy, which is similar to load removal in the engineering case. In the biomedical case, both energy influx and dissipation processes take some time, which is not as simple and quick as the structural load removal in the engineering case. Therefore, the age difference and 3 input behaviors are "dynamic" in nature, i.e. time-dependent. This time-dependent nature leads to a "viscoelastic or viscoplastic" situation. For the author's case, it is "viscoplastic" since most of his biomarkers are continuously improved during the past 13-year time window.

2.4 Time-dependent output strain and stress of (viscous input*output rate)

Hooke's law of linear elasticity is expressed as:

Strain (ε: epsilon)
= Stress (σ: sigma) / Young's modulus (E)

For biomedical glucose application, his developed linear elastic glucose theory (LEGT) is expressed as:

PPG (strain)
= carbs/sugar (stress) * GH.p-Modulus (a positive number) + post-meal walking k-steps * GH.w-Modulus (a negative number)

Where GH.p-Modulus is the reciprocal of Young's modulus E.

However, in viscoelasticity or viscoplasticity theory, the stress is expressed as:

Stress
= viscosity factor (η: eta) * strain rate (dε/dt)

Where strain is expressed as Greek epsilon or ε.

In this article, to construct an "ellipse-like" diagram in a stress-strain space domain (e.g. "hysteresis loop") covering both the positive side and negative side of space, he has modified the definition of strain as follows:

Strain
= (body weight at a certain specific time instant)

He also calculates his strain rate using the following formula:

Strain rate
= (body weight at next time instant) - (body weight at present time instant)

The risk probability % of developing into CVD, CKD, and Cancer is calculated based on his developed metabolism index model (MI) in 2014. His MI value is calculated using inputs of 4 chronic conditions, i.e. weight, glucose, blood pressure, and lipids; and 6 lifestyle details, i.e. diet, drinking water, exercise, sleep, stress, and daily routines. These 10 metabolism categories further contain ~500 elements with millions of input data collected and processed since 2010. For individual deadly disease risk probability %, his mathematical model contains certain specific weighting factors for simulating certain risk percentages associated with different deadly diseases, such as metabolic disorder-induced CVD, stroke, kidney failure, cancers, dementia; artery damage in heart and brain, micro-vessel damage in kidney, and immunity-related infectious diseases, such as COVID death.

Some of explored deadly diseases and longevity characteristics using the viscoplastic medicine theory (VMT) include stress relaxation, creep, hysteresis loop, and material stiffness, damping effect based on time-dependent stress and strain which are different from his previous research findings using linear elastic glucose theory (LEGT) and nonlinear plastic glucose theory (NPGT).

Note: For a more detailed description, please refer to the "consolidated method" section which is given at the beginning of the special issue.

3. RESULTS

Figure 1 shows data tables.

Neural	100%	6%	75%	45%	97%	/ 120	/ 120	/ 120	/ 120	Strain Rate
7/11/23	All meal	Soup	Solid	Egg only	Egg all	Soup	Solid	Egg only	Egg all	All Rate
First-Bite	119.31	104.35	114.99	109.40	115.90	0.87	0.95	0.91	0.97	0.00
15 min	121.48	106.65	117.00	111.75	118.30	0.89	0.97	0.93	0.99	2.17
30 min	125.73	109.00	120.21	114.52	122.22	0.91	1.00	0.95	1.02	4.25
45 min	128.84	110.92	123.97	117.35	125.44	0.92	1.03	0.98	1.05	3.11
60 min	129.21	111.66	125.21	118.34	126.11	0.93	1.04	0.99	1.05	0.37
75 min	126.70	110.97	124.29	117.53	123.95	0.92	1.04	0.98	1.03	-2.51
90 min	124.16	110.89	122.28	116.51	121.63	0.92	1.02	0.97	1.01	-2.54
105 min	121.03	110.36	120.73	115.47	119.07	0.92	1.01	0.96	0.99	-3.13
120 min	118.31	108.90	117.61	113.20	116.54	0.91	0.98	0.94	0.97	-2.72
135 min	117.82	108.76	117.83	113.74	116.46	0.91	0.98	0.95	0.97	-0.49
150 min	118.35	111.36	119.00	115.14	117.12	0.93	0.99	0.96	0.98	0.53
165 min	119.23	113.76	120.71	117.18	118.53	0.95	1.01	0.98	0.99	0.88
180 min	119.51	116.54	122.54	119.51	119.69	0.97	1.02	1.00	1.00	0.28
Avg	122.28	110.39	120.46	115.38	120.07	0.92	1.00	0.96	1.00	0.02

Neural	Strain	Strs 1	Strs 2	Strs 3	Strs 4	Hgt 1	Hgt 2	Hgt 3	Hgt 4	Area 1	Area 2	Area 3	Area 4	
7/11/23	All meal	Soup	Solid	Egg only	Egg all	Soup	Solid	Egg only	Egg all	Soup	Solid	Egg only	Egg all	Time-Zone
First-Bite	119.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0-60 min
15 min	121.48	1.93	2.12	2.02	2.14	0.96	1.06	1.01	1.07	2.1	2.3	2.2	2.3	108.9
30 min	125.73	3.86	4.26	4.06	4.33	2.89	3.19	3.04	3.23	12.3	13.5	12.9	13.7	50%
45 min	128.84	2.87	3.21	3.04	3.25	3.37	3.74	3.55	3.79	10.5	11.6	11.0	11.8	
60 min	129.21	0.34	0.39	0.36	0.39	1.61	1.80	1.70	1.82	0.6	0.7	0.6	0.7	
75 min	126.70	-2.32	-2.60	-2.46	-2.59	-0.99	-1.11	-1.05	-1.10	2.5	2.8	2.6	2.8	75-120 min
90 min	124.16	-2.35	-2.59	-2.47	-2.57	-2.33	-2.59	-2.46	-2.58	5.9	6.6	6.3	6.6	101.2
105 min	121.03	-2.88	-3.15	-3.01	-3.11	-2.61	-2.87	-2.74	-2.84	8.2	9.0	8.6	8.9	47%
120 min	118.31	-2.47	-2.67	-2.57	-2.64	-2.67	-2.91	-2.79	-2.87	7.3	7.9	7.6	7.8	
135 min	117.82	-0.45	-0.48	-0.46	-0.48	-1.46	-1.57	-1.52	-1.56	0.7	0.8	0.7	0.8	
150 min	118.35	0.49	0.53	0.51	0.52	0.02	0.02	0.02	0.02	0.0	0.0	0.0	0.0	135-180 min
165 min	119.23	0.83	0.89	0.86	0.87	0.66	0.71	0.68	0.69	0.6	0.6	0.6	0.6	6.1
180 min	119.51	0.27	0.29	0.28	0.28	0.55	0.59	0.57	0.57	0.2	0.2	0.2	0.2	3%
Avg	122.28	0.01	0.01	0.01	0.03	0.00	0.00	0.00	0.02	50.8	55.9	53.3	56.1	
									216.2					
									SD-ε:	23.5%	25.9%	24.7%	26.0%	

	Soup	Solid	Solid/Soup
Number	320	312	98%
Peak PPG	111.66	125.21	112%
Avg PPG	110.39	120.46	109%
Energy	0.23	0.26	110%

Meal Type	All Meals	Soup	Solid	Egg only	Egg all
Number	9272	320	312	632	2183
Avg. F.PPG	113.4	106.0	110.5	108.3	111.2
Carbs g.	13.6	4.5	5.1	4.8	9.5
Steps	4200	4013	4218	4114	4271

Figure 1: Two data tables.

Figure 2 shows TD and SD-VMT analysis results.

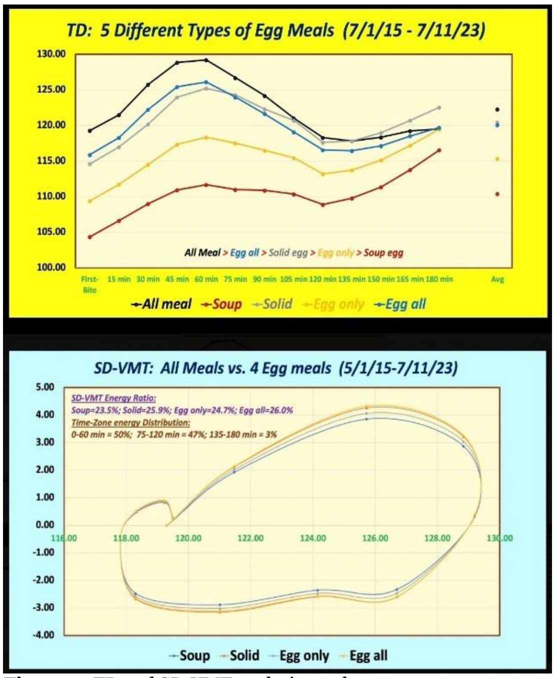

Figure 2: TD and SD-VMT analysis results.

4. CONCLUSION

In summary, there are 5 key findings:

1. Comparison of solid eggs versus liquid eggs showed that peak PPG was 112% and averaged PPG was 109%. Therefore, consuming egg drop soup would result in a 9-14 mg/dL lower PPG value and with the same nutritional value.

2. Results from the SD-VMT energy model showed that egg soups had a PPG energy of 23.5%, solid eggs had 25.9%, egg-only meals had 24.7%, and total egg meals had 26.0%. This demonstrates that consuming egg drop soup would result in 10% less PPG energy in his body.

3. Time-zone analysis revealed that 50% of his total energy was accumulated in the first hour after eating, 47% of energy dissipated through post-meal walking (~4,000 steps) in the second hour, and only 3% was residual energy that could potentially cause damage to internal organs.

4. Overall, the energy levels of all egg meals and solid egg meals were similar and higher than egg-only meals which was further higher than the energy of egg drop soups. This suggests that liquid egg soup meals offer the best benefit for diabetes control.

5. The author suggests that other diabetes patients could try this cooking method or eating style of egg drop soup as a way to deceive the brain into producing less glucose while still maintaining the same nutritional value of meals.

5. REFERENCES

For editing purposes, the majority of the references in this paper, which are self-references, have been removed. Only references from other authors' published sources remain. The bibliography of the author’s original self-references can be viewed at www.eclairemd.com.

Readers may use this article as long as the work is properly cited, their use is educational and not for profit, and the author’s original work is not altered.

For reading more of the author’s published VGT or FD analysis results on medical applications, please locate them through three published special editions from the following three specific journals:

(1) Special Issue. The GH-Method. (https://www.theghmethod.com).

(2) Journal of Applied Material Science & Engineering Research (contact: Catherine).

(3) Advances in Bioengineering and Biomedical Science Research (contact: Sony Hazi).

Special Issue | Issue No. 5

The GH-Method

Viscoelastic and Viscoplastic Glucose Theory Application in Medicine

Gerald C. Hsu

https://theghmethod.com

2022