CIENT PERIODIQUE

Hypothesis on Glucose Production Communication Model Between the Brain and Other Internal Organs, Especially the Stomach and Liver via Studying Glucose Responses Due to Solid Food

Gerald Hsu, C.

EclaireMD Foundation, USA

*Correspondence to:** Dr. Gerald Hsu, C., EclaireMD Foundation, USA.

Copyright

Abstract

Investigating the relationship between meals and postprandial plasma glucose by using glucose responses due to solid food. The author used a continuous glucose monitor device to collect data by focusing on different food inputs for 647 days. He tested his hypothesis on the communication model between the brain and certain specific internal organs via the nervous system by using his experimental data and various mathematical analysis tools. In this particular study, he focused on four different breakfast categories.

Introduction

In this paper, the author described his research results on investigating the relationship between certain type of meals and postprandial plasma glucose (PPG) by using glucose responses due to solid food.

Methods

In September of 2019, the author accidentally noticed his peak PPG at 60 minutes after his first bite of food from eating a pan-fried egg (protein and fat only) breakfast that reached ~150mg/dL, which is very similar

to his McDonald's breakfast's PPG peak (including both "with" and "without" muffin or hash brown). This did not make any sense to him based on his 5-year long research from the relationship between diabetes and food nutrition. Therefore, the meal with egg alone should not generate such a high glucose peak. This incidental discovery challenged him into this particular research.

The author has used a continuous glucose monitor (CGM) device to collect 48,740 glucose data during the past 647 days (from 5/5/2018 through 2/11/2020 at ~75 glucose measurements per day). After the first bite of his meal, he measured his PPG data every 15 minutes for a period of 180 minutes. He focused on investigating the relationships between different food inputs, i.e. meal nutritional contents, cooking methods, physical phases, and different glucose response outputs, i.e. PPG waveforms (post-meal glucose curves). Based on his observation of physical phenomena, i.e. differences of glucose responses, he developed a physics hypothesis about the communication model between the brain and certain specific internal organs via our nervous system. He then tried to verify his hypothesis of this neuro-system communication model regarding PPG production using his experimental data and various mathematical analysis tools.

In this particular study, he focused on the following four different breakfast categories.

First, he ate 233 breakfasts at McDonald's with one egg and one sausage patty (protein and fat only). He occasionally ate half of a muffin (15g of carbohydrates) or one hash brown (16g of carbohydrates). His averaged carbs/sugar amount was 10grams.

Second, he ate 80 McDonald's breakfasts with eggs, without any muffin or hash brown, but sometimes mixed them with other ordered food. His averaged carbs/sugar amount was 7.9grams.

Third, he ate 30 pan-fried egg "solid shape" breakfasts cooked at home without any other food contents with carbs/sugar. His averaged carbs/sugar amount was 0.7grams.

Finally, the fourth meal category of 643 all breakfasts consisting of many different kind of breakfasts (both home cook and dine-out) in more than 20 different international cities. The averaged carbs/sugar contents of this category of these 643 breakfasts was 10.9grams.

It should be noted that the averaged post-breakfast walking steps for these four meal categories are between 4,400 steps to 4,700 steps. The author's target exercise for post-meal walking is 4,000 steps. Since his four exercise amounts were above his target and very comparable to each other; therefore, he can just focus on the food's direct impact on his post-breakfast PPG production.

Results

Figure 1 shows the detailed data of this particular analysis. Two important phenomena of datasets from further analyzing these collected data are:

Sensor PPG	Pan-fried egg	McDonald egg	McDonald Bkfst	ALL Breakfasts
# of Meals	30	80	233	643
Carbs grams	0.7	7.9	10.0	10.9
Post-bkfst walk steps	4679	4708	4621	4463
Avg Finger PPG	115	116	118	117
Avg Sensor PPG	139	137	136	137
PPG mg/dl & % of PPG > 140	147 (46%)	143 (23%)	145 (23%)	145 (31%)
PPG difference (Peak-Start)	22	21	25	26
PPG Peak time	75 min	60 min	60 min	60 min
Sensor PPG	Pan-fried egg	McDonald egg	McDonald Bkfst	All Breakfasts
0 min	130	125	122	123
15 min	135	129	127	128
30 mim	142	136	135	137
45 min	150	142	144	145
60 min	151	145	147	148
75 min	152	141	143	145
90 min	145	140	140	141
105 min	141	137	135	138
120 min	134	136	134	136
135 min	133	136	134	135
150 min	132	137	135	135
165 min	133	136	134	135
180 min	132	135	133	134

Figure 1: Detailed Sensor PPG data table of pan-fried egg vs. McDonald's & All breakfasts

First phenomenon, the PPG difference between "peak" PPG (60-75 minutes after first bite) and "start" PPG (first bite of meal at 0-minute). All of these four PPG differences are very comparable, e.g. Pan-fried egg at 22mg/dL, McDonald's at 21-25mg/dL, and All breakfasts at 26mg/dL. The reason he focuses on PPG difference between start and peak is that breakfast's start PPG value at 0-minute is largely dependent on the morning time's FPG value which has about five primary influential factors. For example, Pan-fried egg's start PPG is about 5mg/dL to 7mg/dL higher than McDonald's and All breakfasts.

Second phenomenon is that the averaged PPG over 3-hour period is quite comparable, e.g. Pan-fried egg at 139mg/dL, McDonald's at 136mg/dL to 137mg/dL, and All breakfasts at 137mg/dL. However, the start PPG of Pan-fried egg is at 130mg/dL while the other three cases are at 123mg/dL to 125mg/dL. If we readjust the averaged PPG by removing the difference of start PPG, the Pan-fried egg should have an averaged PPG at ~134mg/dL.

Based on the observation of above phenomena, in summary, the PPG outcome of Pan-fried egg is remarkably similar to both McDonald's and All breakfasts. However, from the food nutritional viewpoint, we know one large egg contains only 0.38g to maximum of 1g of carbohydrates which is much lower than the averaged carbs/sugar intake of 8g to 11g carbs/sugar from the other three breakfast categories. So, how can we explain the similarity of PPG curves between Pan-fried egg case and other three meal categories ?
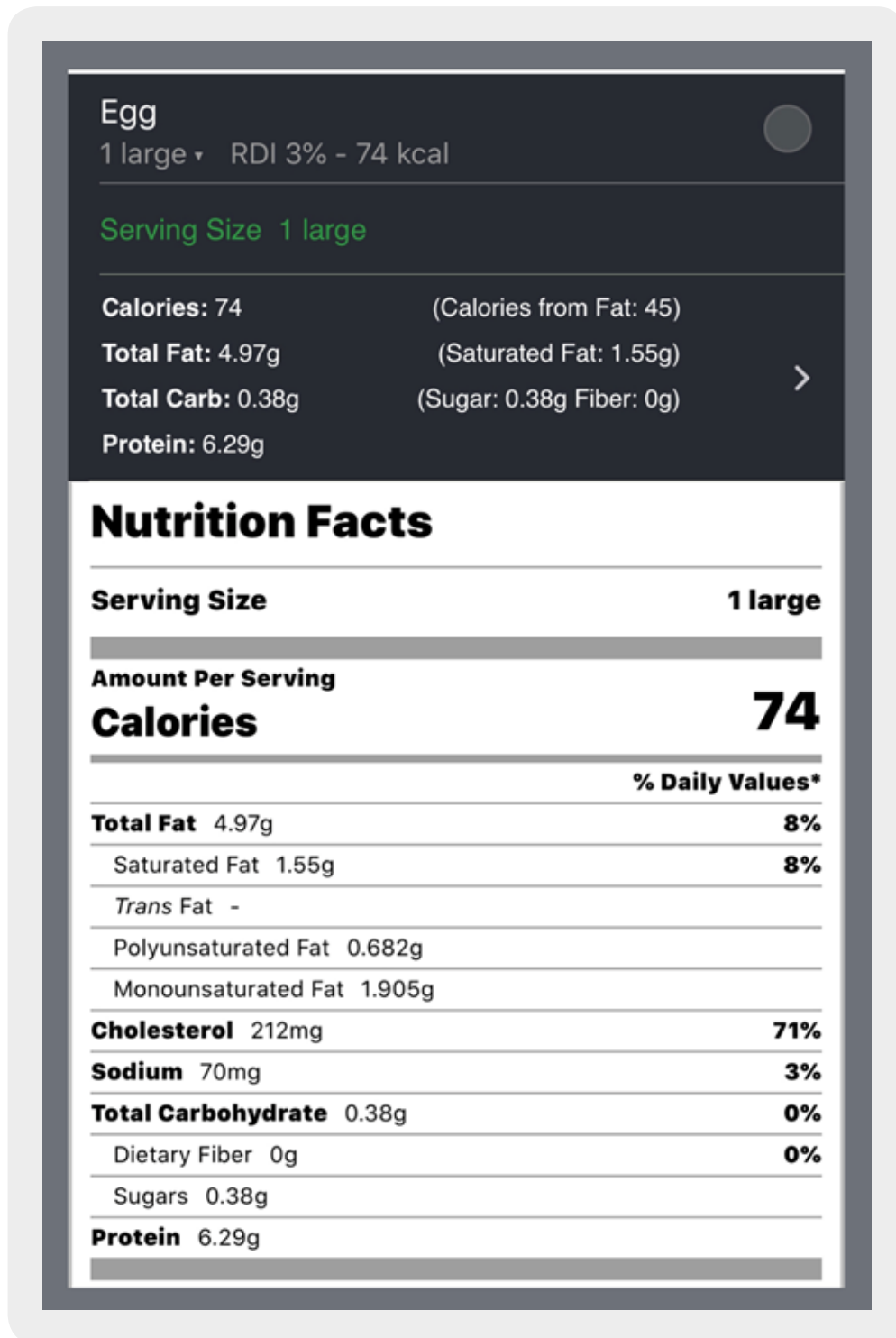
Gerald Hsu, C. (2020). Hypothesis on Glucose Production Communication Model Between the Brain and Other Internal Organs, Especially the Stomach and Liver via Studying Glucose Responses Due to Solid Food. *CPQ Nutrition, 4*(1), 01-06.

Figure 2: Nutritional ingredients of one large egg

We have learned from high school physics that three fundamental phases of matter are solid, liquid, and gas (vapor or steam). This particular breakfast study involves only solid phase food of 30 Pan-fried eggs, 80 McDonald's egg breakfasts, 233 McDonald's breakfasts, and 643 All breakfasts. Due to his acquired deep knowledge of relationship between food nutrition and diabetes, he has maintained a strong discipline of not eating high carbs/sugar food in most of his meals. That is the reason why all of these four PPG curves are clustered together, as shown in Figure 3. However, his other three meal categories containing ~10g carbs/sugar, in theory, should generate a much higher PPG peak values and a higher averaged PPG values than Pan-fried eggs (~1g carbohydrates). Or, the pan-fried egg meals should generate a much lower PPG values and curve from its averaged 0.7 gram of carbs/sugar. Why the observed glucose curve and data of Pan-fried egg are so different from the theoretically predicted glucoses from nutrition viewpoint?
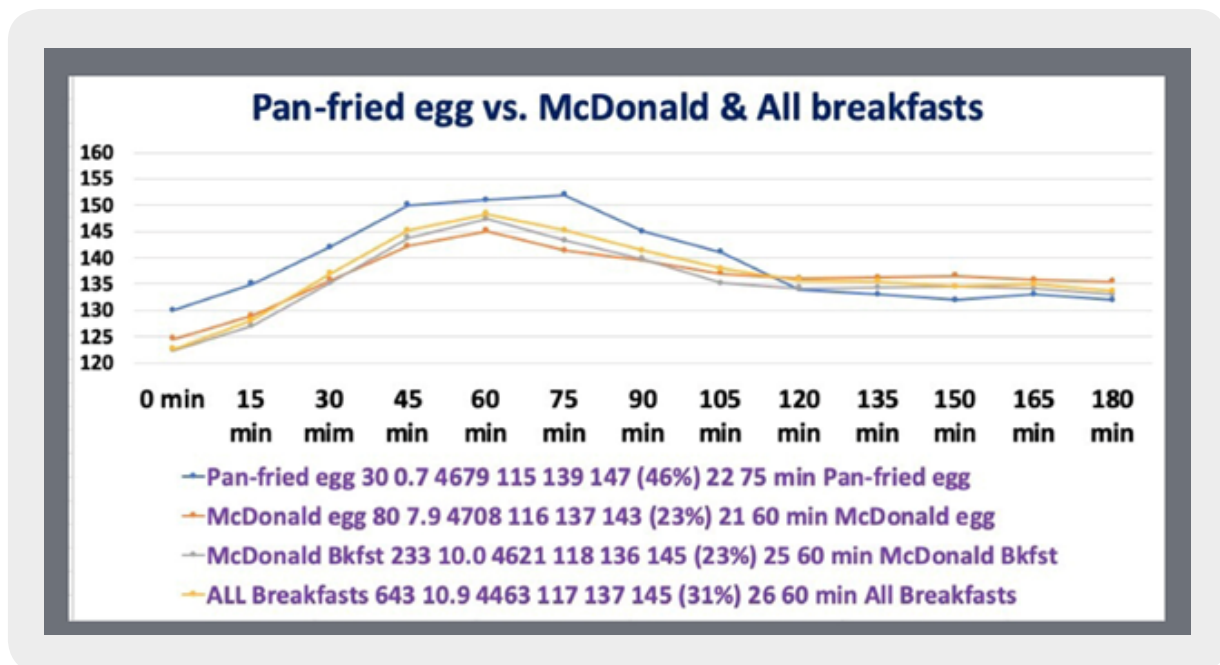

Figure 3: Sensor PPG curves comparison of pan-fried egg vs. McDonald's & all breakfasts

The author has learned three basic facts from his past 9-year of medical research work. First, 70% of our daily energy intake are consumed by our brain and nervous system. Second, the brain is the only internal organ which has the power of cognition, judgement, information processing, and marching order issuance. Third, all of our internal organs are working closely together but under the control of the single command center, the brain.

The author has one *hypothesis* that the glucose produced by the liver is based on the marching order issued from our brain. When one particular food type enters into gastrointestinal system, stomach will immediately send a "food entry" signal to brain to inform about the arrival of food and its physical phase, rather than the detailed carbs/sugar amount which would be send to brain at a later time. After receiving this input signal from the stomach, our brain will then process its received information, make judgements and decisions, and

Gerald Hsu, C. (2020). Hypothesis on Glucose Production Communication Model Between the Brain and Other Internal Organs, Especially the Stomach and Liver via Studying Glucose Responses Due to Solid Food. *CPQ Nutrition, 4*(1), 01-06.

then issue the appropriate marching orders to our liver regarding how much glucose amount should be produced and within what time frame to reach to its peak (of course, exercise also plays a role here).

This particular case study challenged the author to delve deeply about our brain and neuro-system functions using multiple meal categories of food input and glucose response output. This hypothesis explains the author's view on how the brain communicates with both the stomach and liver via the nervous system regarding glucose production during a finite period after the first bite of food.

At the same time, the brain will also inform our pancreas regarding how much insulin should be produced when an excessive glucose amount is produced by the liver. However, for severe diabetes patients whose pancreatic beta cells are damaged, their insulin production capabilities will not function accurately or properly as a normal person [1-5].

Conclusions

The author is trying to apply a scientific method by using his math-physical medicine (MPM) and exploring our brain and neuro-system's role in our glucose production process from a neuroscientific viewpoint.

By sharing his research findings with other fellow medical research scientists, he hopes that they can also provide some explanations regarding this phenomenon by using a different or traditional research methodology such as biochemical medicine (BCM) approach.

Bibliography

1. Hsu Gerald, C. (2018). Using Math-Physical Medicine to Control T2D via Metabolism Monitoring and Glucose Predictions. *Journal of Endocrinology and Diabetes, 1*(1), 1-6.

2. Hsu Gerald, C. (2018). Using Signal Processing Techniques to Predict PPG for T2D. *International Journal of Diabetes & Metabolic Disorders, 3*(2), 1-3.

3. Hsu Gerald, C. (2018). Using Math-Physical Medicine and Artificial Intelligence Technology to Manage Lifestyle and Control Metabolic Conditions of T2D. *International Journal of Diabetes & Its Complications, 2*(3), 1-7.

4. Hsu Gerald, C. (2018, June). *Using Math-Physical Medicine to Analyze Metabolism and Improve Health Conditions*. Video presented at the meeting of the 3rd International Conference on Endocrinology and Metabolic Syndrome 2018, Amsterdam, Netherlands.

5. Hsu Gerald, C. (2018). Using Math-Physical Medicine to Study the Risk Probability of having a Heart Attack or Stroke Based on Three Approaches, Medical Conditions, Lifestyle Management Details, and Metabolic Index. *EC Cardiology, 5*(12), 1-9.