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Hypothesis on Glucose Production Communication Model between the Brain and Internal Organs via Investigating the PPG Values of Pan-fried Solid Egg Meal vs. Egg Drop Liquid Soup Meal

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Introduction

In this paper, the author described his 5-month research study results, from October 2019 through February 2020, to identify a specific nervous system's communication model between the brain and certain internal organs, i.e. stomach and liver, regarding postprandial plasma glucose (PPG) production via investigation of pan-fried solid egg meal and egg drop liquid soup meal.

Method

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 three hours (180 minutes). He focused on investigating the relationships between different food inputs such as meal nutritional contents, cooking methods, physical phases and different glucose outputs, i.e. PPG waveforms (post-meal glucose curves). Based on his observation of physical phenomenon differences of glucose results, he developed a hypothesis for a communication model between the brain and certain internal organs via nervous system. He tried to verify his hypothesis of this nervous system communication model between the brain and liver regarding PPG production amount and timing by using his experimental food and PPG data and various mathematical analysis tools.

In this particular study, he focused on the following two specific meal categories which involved eggs only. The main difference between these two "egg alone" meal categories is the cooking method. From Figure 1, a large egg contains mainly proteins (6.3g) and fat (5g), and small amount of carbohydrates (0.38g).

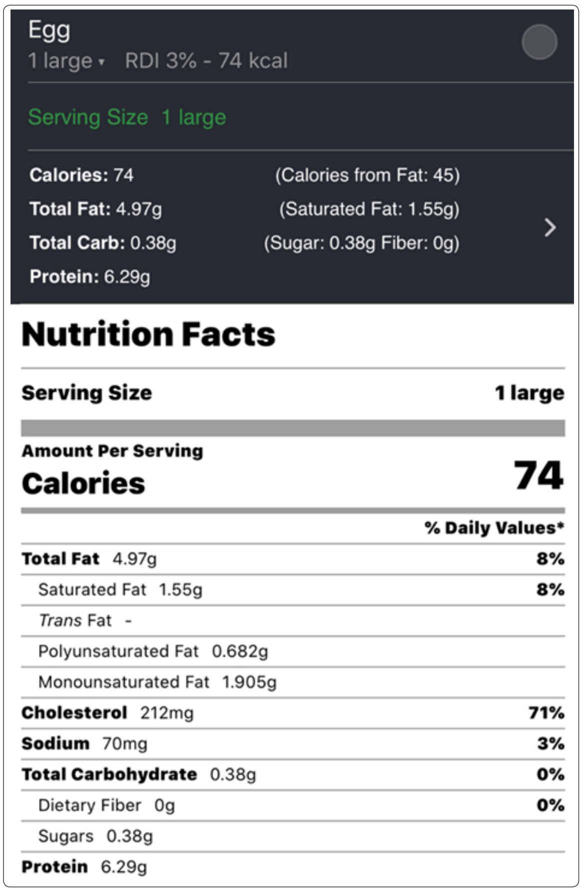

Figure 1: Nutritional ingredients of one large egg

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In the first category, he ate 30 pan-fried egg “solid shape” breakfasts at home without any other contents with carbs/sugar ingredients. This “solid phase” of pan-fried eggs has an averaged carbs/sugar amount of 0.7 gram.

The second category, he also ate 30 egg drop soup meals (pouring mixed eggs into boiling hot water slowly to make thin-layered egg “clouds or sheets” in the soup). This “liquid phase” of egg drop soup has the exact same type and amount of nutritional ingredients as the pan-fried “solid phase” egg breakfast at home, which contains only protein and fat without any significant carbs/sugar. This “liquid phase” egg drop soup has an averaged carbs/sugar amount of 0.8 gram.

It should be noted that the averaged post-breakfast walking steps for both meal categories are 4,679 steps for pan-fried egg and 4,843 steps for egg drop soup. The author’s personal target of post-meal walking is 4,000 steps. Since his post-meal exercise amounts for these two categories are almost equal, he can mainly focus on the food’s influence on his PPG.

Results

Figure 2 shows the detailed data table of this particular analysis. Two important phenomena of datasets from further analyzing these collected data are:

For the first dataset, the PPG difference is the “peak” PPG (45-75 minutes after first bite) and “start” PPG (first bite of meal at 0-minute). The reason he focuses on the PPG difference between start and peak is that breakfast’s start PPG value at 0-minute is largely dependent on each morning’s FPG value, which involves about five primary influential factors. For example, the Pan-fried egg meal’s start PPG is 14 mg/dL higher than the start PPG of egg drop soup meals. It is obvious that the PPG differences are 22 mg/dL for pan-fried egg and 4 mg/dL for egg drop soup which has a difference of 18 mg/dL between them. Therefore, if we focus on PPG difference between start and peak values, then we can remove the influence from the differences from the start of PPG.

Sensor PPG	Egg drop soup	Pan-fried egg
# of Meals	30	30
Carbs grams	0.8	0.7
Post-bkfst walk steps	4843	4679
Avg Finger PPG	108	115
Avg Sensor PPG	117	139
PPG mg/dl & % of PPG > 140	0 (0%)	147 (46%)
PPG difference (Peak-Start)	4	22
PPG Peak time	45 min	75 min
Sensor PPG	**Egg drop soup**	**Pan-fried egg**
0 min	116	130
15 min	118	135
30 mim	119	142
45 min	120	150
60 min	118	151
75 min	115	152
90 min	115	145
105 min	115	141
120 min	114	134
135 min	114	133
150 min	116	132
165 min	120	133
180 min	121	132

Figure 2: Detailed Sensor PPG data table of pan-fried egg vs. egg drop soup

The second dataset is that the averaged PPG over a 3-hour period for these two categories are also very different. Pan-fried egg meals have an average sensor PPG at 139 mg/dL and egg drop soup meals have an averaged sensor PPG of 117 mg/dL, which has a difference of 22 mg/dL between them as well. This observation can be seen clearly in Figure 3 with the PPG curves comparison: the egg drop soup’s curve is much flatter than pan-fried egg’s curves with a much higher peak.

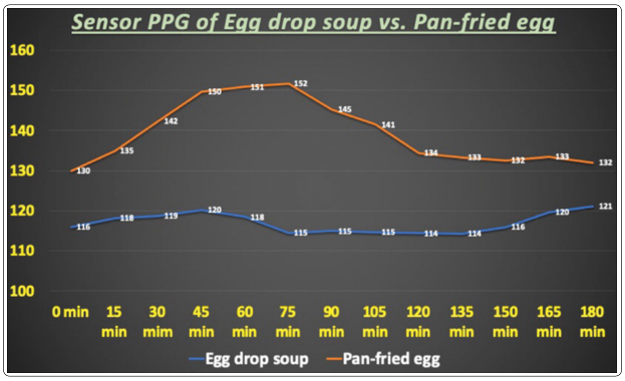

Figure 3: Sensor PPG curves of pan-fried egg vs. egg dr

It is interesting to note that the averaged finger PPG of 115 mg/dL for pan-fried egg which is slightly higher than the averaged finger PPG of 108 mg/dL for egg drop soup. The finger PPG difference is only 7 mg/dL while the sensor PPG difference is 22 mg/dL. This shows the difference due to different glucose monitoring devices.

Based on the author’s previous research, the PPG response of Pan-fried egg is very similar to his overall breakfast involving other kinds of solid foods. However, from the food nutritional viewpoint, we already know that one large egg contains only 0.38 gram of carbohydrates, which is the same amount for both pan-fried egg and egg drop soup. So, how can we explain the significant difference of PPG data amounts and PPG curves between the case of Pan-fried egg and Egg drop soup?

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 includes both solid phase food of 30 Pan-fried eggs and liquid phase food of 30 Egg drop soup. This specific research involves only one food material, the egg, which has extreme low carbs/sugar ingredients; however, it has two different PPG end-results for the solid phase vs. liquid phase based on the outcome of using different cooking methods. Why the observed glucoses are so different?

When the author could not find a satisfactory explanation from a pure food nutritional direction and empirical diabetes experiences, he started to delve deeper into the source of this problem: the creation of “glucose”. He realized that the glucose is *not directly converted* from food nutritional ingredients. Instead, the glucose was *directly produced* by the liver. Of course, the human body and internal organs, including the liver, are depending on food supply for their needed energy.

Therefore, the author came up with his first hypothesis that the glucose difference is probably due to the consumed food’s physical phase such as liquid or solid.

Furthermore, the author has learned three basic facts from his past 9-years 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, decision making, and marching order issuance. Third, all of our internal organs are working closely together but under the orders from a single command center of the brain.

Based on the above acquired biomedical knowledge, the author further developed his *second hypothesis*. When one particular food type enters into gastrointestinal system, stomach will immediately send a signal to inform brain about the food entry and its physical phase. After receiving the input signal from the stomach, brain will then start to process information, make proper judgements and precise decisions, and then issue the appropriate marching orders to liver regarding how much glucose amount should be produced and within what time frame to reach to the glucose peak. At the same time, the brain will also inform pancreas regarding how much insulin should be produced when an excessive amount of glucose has been produced by liver. For example, the author has observed from his 8,886 food and glucose experiments during the past 8-years that our body takes about 10-15 minutes to reach the glucose peak from high sugar content liquid food intake, about 45-60 minutes to reach the glucose peak from liquid food intake, and about 60-75 minutes to reach the glucose peak from solid food intake. However, for severe diabetes patients whose pancreatic beta cells are damaged, their insulin production capabilities will not be accurately or properly functioning. This particular hypothesis explains the author's view on how the brain communicates with both the stomach and liver via our nervous system regarding PPG production during the 180 minutes period after the first bite of our food.

Of course, the author will continue to experiment on eating more other nutritional type of liquid phase soup. He has also urged other two type-2 diabetes (T2D) patients, who are using the CGM device to conduct similar experiments in order to collect more glucose data from T2D patients with different DNA and diabetes disease conditions.

Conclusions

The author tried to find a scientific method by utilizing his established math-physical medicine (MPM) and exploring our complex biomedical system from a neuroscience viewpoint to "*trick*" our brain into producing "less" amount of glucose, after eating food without altering or lacking the required and balanced food nutritional ingredients. If this works, by just changing the cooking method, it can help many T2D patients to lower both their peak PPG and averaged PPG levels without reducing or altering their food nutritional contents. Of course, T2D patients must avoid overeating food with high carbs/sugar contents all of the time.

By sharing his research findings with other fellow medical research scientists, he hopes that they can provide some explanations or further justifications to the medical community by using a different or traditional research methodology, such as biochemical medicine (BCM) approach [1-5].

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