ISSN: 2690-0726

Mini Review Article

Journal of Educational & Psychological Research

Two Clinical Cases to Demonstrate the Communication Model Between the Brain and Certain Internal Organs As Well As the Health State of the Pancreatic Beta Cells

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Submitted: 06 Jun 2020; **Accepted:** 12 Jun 2020; **Published:** 20 Jun 2020

Introduction

In this paper, the author presents the results of two clinical cases of CGM Sensor PPG data to confirm his hypotheses regarding the possible communication model between the brain and stomach/liver/pancreas as well as the comparison of the health state of the pancreatic beta cells.

Methods

The author has selected two clinical cases:

(A) 72-year-old male, 25-year T2D patient, with no medications for four years.

(B) 71-year-old female, 22-year T2D patient, with no medications for one year.

He utilized 1,040 glucose data (80 glucose data per day) during a period of 13 days (12/6-18/2919) for analysis and comparison of glucoses. Furthermore, for breakfast on 12/12/2019, both patients ate the same single pan-fried egg breakfast followed by ~4,000 post-meal walking steps. He used their PPG waveforms (based on 13 PPG data per meal) within the same 180 minutes timespan for comparison.

Results

The first study had an aim of studying the communication model between the brain and stomach, liver, and pancreas using the 12/12/2019 breakfast PPG data within 180 minutes timespan. Figures 1 and 2 depict the results.

The glucose differences at different time instance are listed below (Case A PPG minus Case B PPG; A&B average PPG; average PPG minus 120 mg/dL):

0-minute: 33; 123; 3
30-minutes: 37; 131; 11
60-minutes: 22; 152; 32
75-minutes: 24; 168; 48
120-minutes: 20; 135; 15
135-minutes: 33; 123; 3
180-minutes: 30; 114; -6

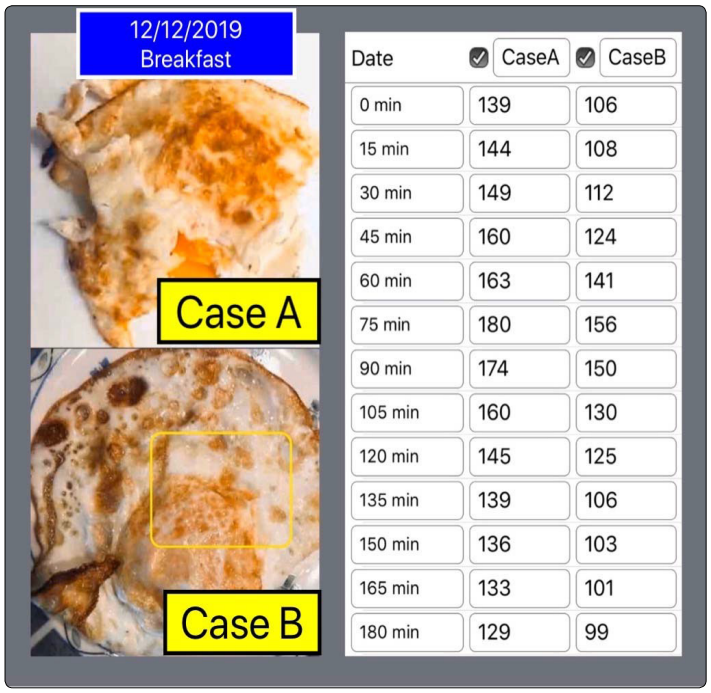

Figure 1: Same Breakfast for both Case A and Case B

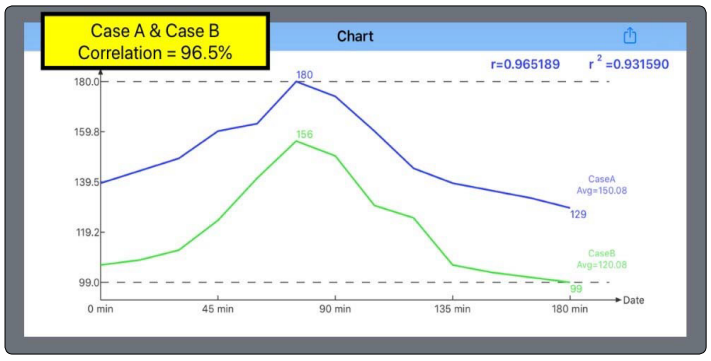

Figure 2: Sensor PPG Curves for Case A and Case B (R=96.5%)

The first column's data (Case A minus Case B) are relatively close to each other, within a range of 20 mg/dL to 33 mg/dL. This is why the ultra-high 96.5% correlation coefficient existed between these

two cases. The second column's data, average glucoses of case A and Case B, repeatedly show the high similarity of waveforms of these two cases. It also serves for further calculations which leads into the third column's data (the "Gap" value: average glucose minus 120 mg/dL). They show the PPG variance at different time instance and their comparison against a "healthy" state of 120 mg/dL.

In Figure 3, a glucose Gap value of 3 at the open instance (0-minute) indicates that the stomach is sending food entry message to the brain. At the time instance of 30-minutes, most of the carbs and sugar digestion work have been processed. Therefore, a Gap value of 11 indicates that the stomach is sending a message to the brain, which orders both the liver to produce glucose and the pancreas to produce insulin. At the time instance of 75-minutes, carbs and sugar are fully digested. Therefore, a Gap value of 48 indicates that the PPG is reaching its peak. At the same time, due to existing different degree of pancreatic beta cells damage for both patients, the glucose produced by the liver could not be completely suppressed down by the pancreas with its insulin production (insulin resistance). At the time instance of 135-minutes, all of the energy generated via carbs/sugar intake have been burned off via post-meal walking exercise. Therefore, a Gap value of 3 (the same as opening Gap of 3) indicates that there are no more excessive energy left inside the patient's body. Finally, further moving into the closing instance of 180-minutes, a Gap value of -6 indicates that the PPG level of 114 mg/dL is "Normal".

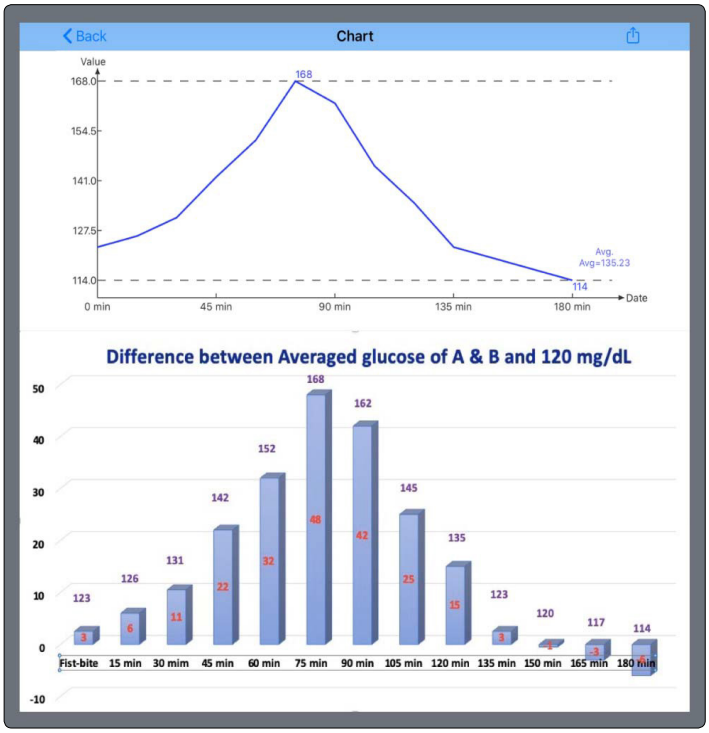

Figure 3: Average glucoses of Case A & Case B and its difference with 120 mg/dL

The above paragraph has described the author's hypothesis of his developed communication model between the brain and stomach, liver, and pancreas. The observed physical phenomenon and mathematical model of these biomedical condition have been presented by the author at several medical conferences in 2018. However, this "single-egg breakfast" special case has further proved the accuracy of his hypothesis regarding the brain function to control both liver and pancreas via our neuro-system. It also depicts graphically the different health states of the pancreatic beta cells between Case A (worse) and Case B (better).

From Figure 4 and 5, by using a longer period of glucose data, it can further prove the health state of the pancreatic beta cells of these two different cases. The -40% correlation between these two cases of daily average glucose (80 data per day) during a period of 13 days (12/6-18/219) shows that there are no similarities between these two cases regardless of no medications and the same data collection methods for both patients. The average daily glucoses are 130 mg/dL for Case A and 118 mg/dL for Case B. This fact of glucose difference further indicates Case A's pancreatic health state is worse than Case B.

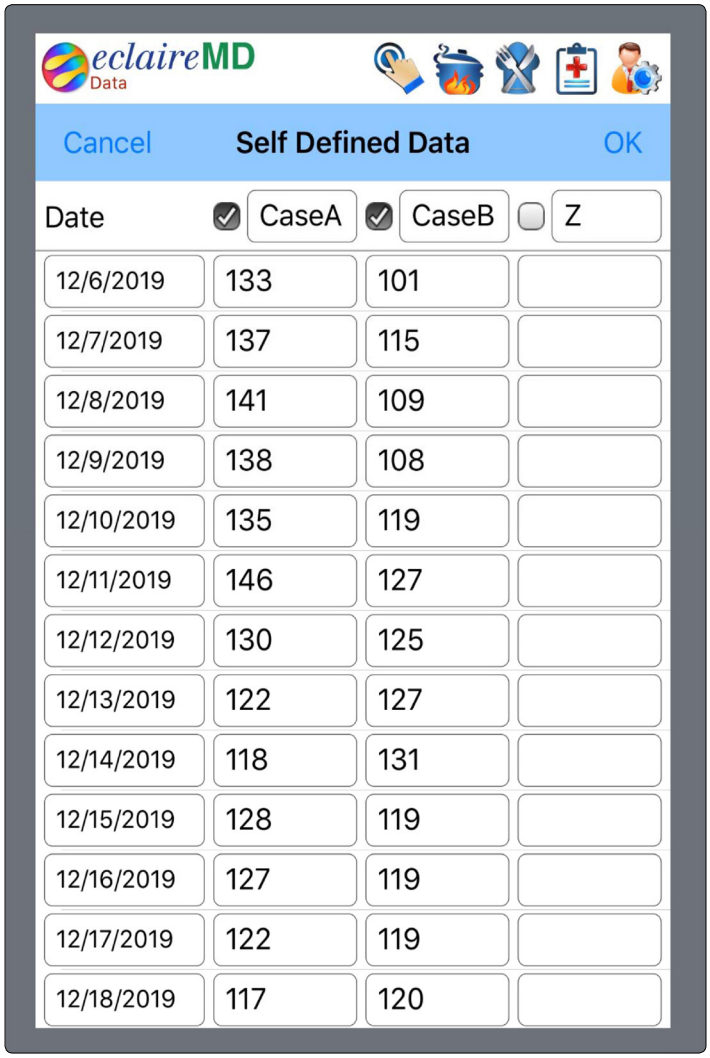

Figure 4: Data Comparison of Sensor daily glucose data between Case A and Case B

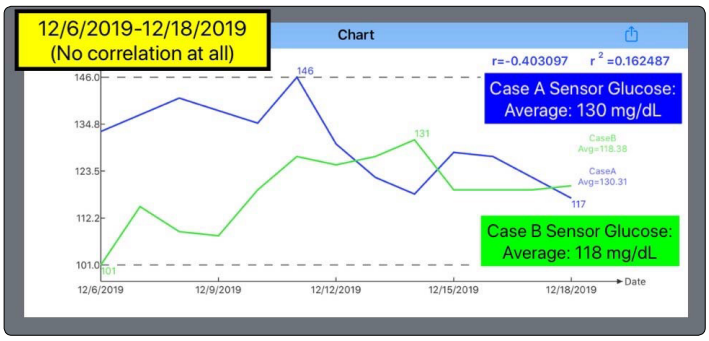

Figure 5: Graphic Comparison of daily glucose data between Case A and Case B (No correlation at all: -40%)

Conclusion

This special sensor PPG study has further demonstrated the close relationship and communication model between the brain and stomach, liver, and pancreas as well as the fact of PPG level is depending on the overall health state of the pancreatic beta cells of patient.

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