

Investigation on the Impact of Snacks and Fruits on Daily Glucose Level and Diabetes Complications (GH-Method: Math-Physical Medicine)

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INTRODUCTION

This paper describes the detailed analysis of segmental contribution on the Sensor glucose and the special high glucose component's impact via snacks and fruits from diabetes complications using GH-Method: math-physical medicine methodology. The GH-Method: Math-physical medicine (MPM) starts with the observation of the human body's physical phenomena not biological or chemical characteristics, collecting elements of the disease related data (preferring big data), utilizing applicable engineering modeling techniques, developing appropriate mathematical equations not just statistical analysis, and finally predicting the direction of the development and control mechanism of the disease.

METHODS

Since 5/5/2018, the author has applied a continuous glucose monitoring device (Sensor) on his upper arm and measured his readings 74 times per day. During a period of 396 days (5/5/2018 - 7/5/2019), he has collected 29,304 glucose data.

He further divided these collected daily 74 glucose data points into the following three segments with different measurement counts and percentage of total daily data (74 counts/day):

- (1) FPG: 11 point or 15%
- (2) PPG: 36 points or 49%
- (3) In-between : 27 points or 36%

The "in-between" periods or "pre" periods include both "pre-meal and pre-bed" categories.

This research analyzed those glucose data points which belong to "in-between" category (pre-lunch, pre-dinner, and pre-bed) with glucoses level >140 mg/dL.

The author is a severe type 2 diabetes (T2D) patient who does not take any diabetes medication. Therefore, his diabetes control relies on a stringent lifestyle management program. He does not include any fruit intake in his three normal meals to avoid pushing his PPG peak higher. In addition, he rarely eats any processed snacks. However, most of the diabetes patients, including the author, from time to time, still have cravings for some snacks which contain heavy amounts of carbohydrates and sugars. On other hand, fruits are one of the necessary nutritional sources for human health. That is why the author wants to find out how much of an impact snacks and fruits have on his overall glucose due to higher glucose components (>140 mg/dL) during those "in-between" periods.

Finally, he conducted a quick calculation of the impact from snacks and fruits on cardiovascular disease (CVD), stroke, and renal complications.

RESULTS

As shown in Figures 1 & 2, and Table 1, the following summarized results can be observed:

- (1) He has collected a total of 29,304 glucoses data points during 396 days with a daily averaged Sensor glucose of 130.5 mg/dL (overall glucoses).
- (2) The three different segmental contributions and averaged segmental glucoses are: (a) FPG: 13% & 18 mg/dL; (b) PPG: 55% & 74 mg/dL; (c) Pre-: 29% & 39 mg/dL.
- (3) Within the same sensor data time period, it has 13 mg/dL of high glucose (>140 mg/dL) resulting from snacks/fruits on daily averaged glucose of 130 mg/dL.
- (4) The ratio of this "snack/fruit glucoses" over "overall glucoses" is 10% which is nominal in comparison with the influence from PPG (3 normal meals) of 55% or 74 mg/dL over total daily glucose.

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(5) Using the author’s previous publications and his 2017 data as a base, the incremental impact on risk probabilities of CVD/Stroke is +1.5% and the risk probability of Renal Complications is +1.3%. Even though these two incremental risk probabilities are nominal but still important to know because T2D patients must be aware of any increased risk of diabetes complications.

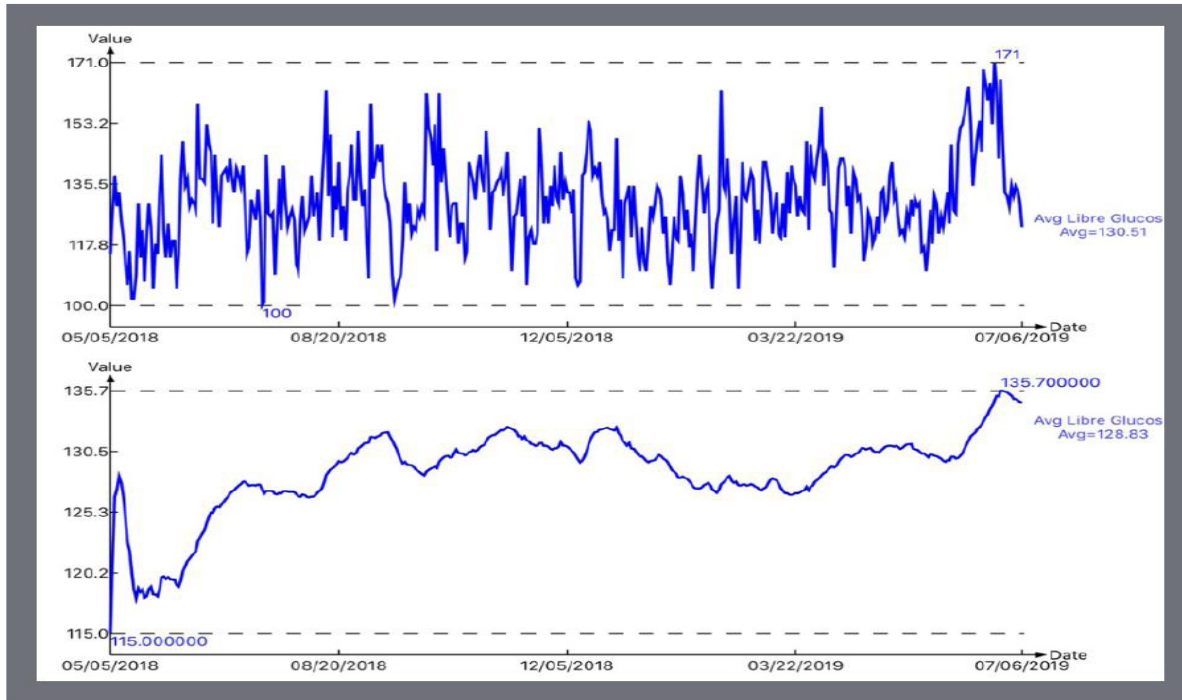


Figure 1. Sensor glucoses

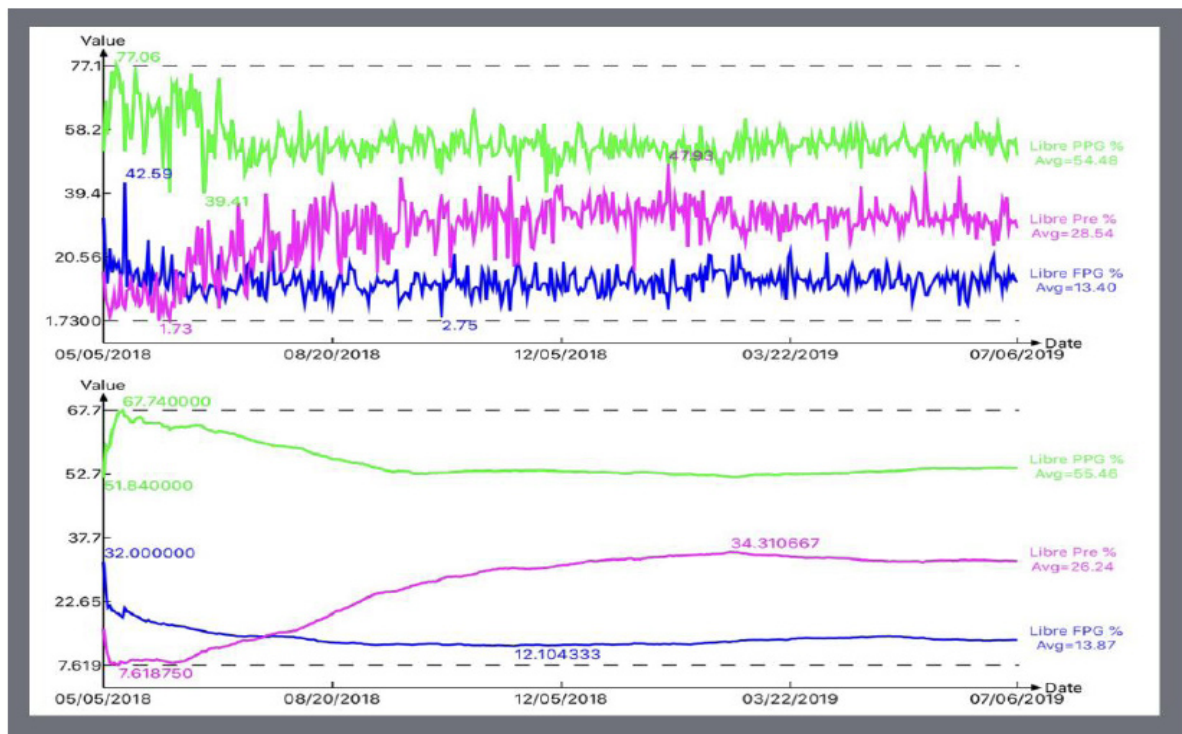


Figure 2. Segmental contribution % by FPG, PPG, and in-between (Pre- periods)

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Table 1. Summary results of segmental distribution % and higher glucose (>140 mg/dL) contribution via fruits/snacks

Senmsopr Glucose Analysis	Glucoset Counts	Count %	Avg. Glucose (%)	Avg. Glucose (mg/dL)
FPG	11	15%	13.4%	18.1
PPG	36	49%	54.5%	73.7
Pre- (pre-meal & pre-bed)	27	36%	28.5%	38.6
Total	74	100%	96.4%	130.5
Pre- (Fruits/Snacks >140mg/dL)			10.0%	13.1

CONCLUSION

This big data analytics has shed some light on the impact of snacks and fruits on overall diabetes conditions and its complications. Although they are not significant, it is still important to possess this knowledge in order to better manage diabetes conditions and its complication risk. Based on findings from this analysis, the author has decided to do his best to avoid eating any snacks with high carbs/sugar content (i.e. big portion). He also tries to divide his needed fruit intake into smaller portions to be eaten at separate time slots in order to avoid high glucose peaks from fruit sugar content. This specific quantitative knowledge and experience can be shared with other T2D patients.

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