Using GH-Method: Math-Physical Medicine to Conduct Segmentation Analysis to Investigate the Impact of Low-Carb and High-Carb Diets on Postprandial Plasma Glucose

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Abstract

The author developed his GH-Method: math-physical medicine (MPM) by applying mathematics, physics, engineering modeling, and computer science such as big data analytics and artificial intelligence to derive the mathematical metabolism model and three prediction tools for weight, FPG, and PPG with > 30 input elements. This research paper is based on a collection of big data of 1,449 days reflecting the 4,347 meals of carbs/sugar intake amount and postprandial plasma glucose results for low-carb and high-carb diets.

Keywords: Type 2 Diabetes; Low-Carb Diet; High-Carb Diet; Postprandial Plasma Glucose; Artificial Intelligence; Math-Physical Medicine

Introduction

This paper is based on big data collected from a period of 1,449 days from 5/1/2015 to 4/19/2019 with 4,347 meals of carbs/sugar intake amount (grams per meal and per day) and measured postprandial plasma glucose (PPG) in mg/dL. The dataset is provided by the author, who uses his own type 2 diabetes metabolic conditions control, as a case study via the “math-physical medicine” approach of a non-traditional methodology in medical research.

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 [1-5].

Method

In this analysis, the author selected the following carbs/sugar amount definition as his “low-carb diet”: Less than 18 grams per meal and less than 6 grams for his daily snacks or fruits intake in between meals, so that his daily upper limit of carbs and sugar intake amount is 60 grams.

The chosen target is consistent with the general consensus of low-carb diet definition (<60 grams of carbs/sugar intake per day). He further separated his data into two groups as low-carb diet vs. high-carb diet.

Results and Discussion

Low-carb diet

- Carbs/sugar per meal: 9.6 grams
- Carbs/sugar per day: 32 grams
- Average PPG: 112 mg/dL
- Contribution ratio: 74%.

High-carb diet

- Carbs/sugar per meal: 28.8 grams
- Carbs/sugar per day: 96 grams
- Average PPG: 134 mg/dL
- Contribution ratio: 26%.

Overall mixed diet

- Carbs/sugar per meal: 14.4 grams
- Carbs/sugar per day: 48 grams
- (still under "low-carb diet")
- Average PPG: 118 mg/dL

PPG has a nonlinear and complicated inter-relationship with its 19 influential factors. Among them, the combined contribution from both carbs/sugar intake and post-meal exercise is ~80% (carbs/sugar ~39% and exercise ~41%).

Figure 1: Low-carb diet and high-carb diet.
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**Figure 2:** Daily and average PPG values.

**Table 1:** Low-carbs, High-carbs, and Daily mixed diets.

<table>
<thead>
<tr>
<th>Summarized Table</th>
<th>Low Carb</th>
<th>High Carb</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbs/Sugar</td>
<td>0.48</td>
<td>1.44</td>
<td>0.72</td>
</tr>
<tr>
<td>Per Meal (g)</td>
<td>9.6</td>
<td>28.8</td>
<td>14.4</td>
</tr>
<tr>
<td>Per Day (g)</td>
<td>32</td>
<td>96</td>
<td>48</td>
</tr>
<tr>
<td>PPG (mg/dL)</td>
<td>112</td>
<td>134</td>
<td>118</td>
</tr>
<tr>
<td>Contribution %</td>
<td>74%</td>
<td>26%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Conclusion

By using the GH-Method: math-physical medicine, the author investigated the impact from both low-carb and high-carb diets on PPG. Through this quantitative analysis, it is obvious that low-carb diet is extremely effective and also important on diabetes control. Although this patient is strong willed and disciplined, it is revealed that he still has cravings for high-carb diets from time to time (~27%), which some of them were under non-controllable environment such as airline in-flight food.

Bibliography


