

Preventing Post-Prandial Elevation of Blood Glucose by Breakfast with Less Carbohydrate

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Abstract

Post-prandial blood glucose has attracted attention in the light of adequate diabetic control. Regarding adequate diet therapy, various types are observed such as low carbohydrate diet (LCD), calorie restriction (CR) and Mediterranean diet. Authors and co-researchers have presented clinical diabetic research for long through Japan LCD Promotion Association (JLCDPA). Our proposal includes novel C-peptide index for Carbohydrate-70 (CPI-Carbo70) test using standard Japanese breakfast including 70g of carbohydrate. Before lunch, moderate decrease of blood glucose is usually found, in which the decreasing speed may bring stronger hunger sensation, leading to increased appetite, and increased eating amount for total daily intake.

Keywords: Post-prandial blood glucose; C-peptide index for Carbohydrate-70 (CPI-Carbo70); low carbohydrate diet (LCD); Calorie restriction (CR); Japan LCD promotion Association (JLCDPA)

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Commentary

Although there are all kinds of diets in the world, it is difficult to adhere to all diets while keeping health in mind. LCD and Mediterranean diets are well-known for adequate type for diabetes [1,2], but Effects of the Dietary Approach to Stop Hypertension (DASH) diet and Nordic diets have also been proposed [3,4]. As a group of the European Association for the Study of Diabetes (EASD), Diabetes and Nutrition Study Group (DNSG) has summarized and provided evidence-based guidelines to health professionals [5]. When analyzing enormous data, they use the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) approach. Important messages include i) minimum processed plant food which are whole grains, whole fruit, vegetables, ii) decreasing sugar-sweetened beverages, refined grains, sodium, red and processed meats.

There are three meals a day, and breakfast is the one that is least affected by the social environment and personal life. Recently, there has been a study that examined the effect of using low carbohydrate diet (LCD) or calorie Restriction (CR) breakfast on blood glucose control [6]. Two types of breakfast were provided to 121 patients with type 2 diabetes (T2D), average age 64, for 12 weeks and compared. For its content, LCD had 8g of carbohydrates

8g and 465kcal, and CR had carbohydrate 56g and 450kcal. The decrease in HbA1c was -0.3% for the former and -0.1% for the latter, a difference of -0.2%. The difference in self-reported total daily energy was -242kcal (p=0.03) and -73g carbohydrate, p<0.01. From these results, the noteworthy fact would be the influence of CR for breakfast. Between LCD and CR, no difference was found for intake of dinner and snacks, but the energy intake of lunch is higher in CR breakfast. Consequently, total daily energy intake also increased in CR breakfast group. The reason would be due to the changes in post-prandial glucose. For LCD breakfast, blood glucose does not rise. In contrast, CR breakfast raises blood glucose rapidly and it will decrease after the peak. From the obtained data of questionnaire, CR breakfast results in elevated sense of hunger feeling before lunch. Actually, the values of breadth or speed of decreasing blood glucose before lunch may bring strong hunger sensation, much appetite and increased meal intake [7].

In this study, 8,624 standardized meals were consumed and analyzed [7]. The results showed the following successive process. They are i) a decrease in blood glucose about 2-3 hours after meal, ii) an increase in hunger for 2-3 hours, iii) a reduction in the time until the next meal, iv) an increase in energy intake in 3-4 hours, and v) an increase in energy intake in 24 hours. These data

showed all significant difference (all $p < 0.001$). Consequently, this would be an distinctive evidence that suggests a relationship among changes in postprandial blood glucose, changes in appetite and energy intake [8].

Concerning the relationship among diet, appetite, and obesity, big meals at dinner have been attracting attention so far [9]. From this report, however, it has become clear that differences in hunger and food intake are significantly influenced by the amount of carbohydrates in breakfast. In other words, paying a little attention to breakfast can affect several markers such as amount of food eaten throughout the day, total calorie intake, body weight, and HbA1c. Thus, it is meaningful to pay attention to the carbohydrate content of breakfast, which may influence clinical progress of patients with diabetes, obesity and life style-related diseases.

For adequate treatment for diabetes, and metabolic syndrome, authors and collaborators have continued diabetic clinical studies in LCD and CR for years [10,11]. The patients were type 1, 2 diabetes (T1D, T2D), slowly progressive insulin-dependent diabetes mellitus (SPIDDM), and lifestyle-related diseases [10,12]. Among our research investigation, we have proposed novel C-peptide index for Carbohydrate-70 (CPI-Carbo70) test for

analyzing the glucose variability [11]. It can use usually Japanese style breakfast including 70g of carbohydrate. The protocol included 37 T2D cases with average HbA1c 8.1% and median Morbus (M) value 70.5. The results showed the values of 0 vs 30min as 163 mg/dL vs 195mg/dL, 1.1 vs 1.5 μ U/mL, respectively. Thus, CPI-Carbo70 revealed 1.94 in average and 1.54 in median. Significant negative correlation was found between HbA1c and CPI-Carbo70, that showed $y = -0.2479x + 0.217$, $R^2 = 0.2019$. Thus, CPI-Carbo70 seemed to be useful for indication insulin secretion and resistance situation in diabetic patients. Furthermore, our CPI-Carbo70 study showed advanced method. T2D cases (n=46) were divided into 3 groups, which were HbA1c 6.6%, 7.8%, 10.0%, respectively [13]. Increase of CP and CPI-Carbo70 revealed 0.58, 0.57, 0.27 and 2.1, 3.2, 1.2, respectively. Several factors may be involved in these results. Consequently, CPI-Carbo70 may be effective for evaluating glucose variability and pancreas function, leading to future research development.

As to CPI-Carbo70, Japanese style breakfast has been originally applied. Furthermore, western style breakfast has been also developed. Two types of breakfast are shown in Figure 1, in which carbohydrate amount is 4.2g and 69.7g, respectively.



breakfast sample	cuisine	carbo
	low-carbo bread	2.8
	omelette	0.3
	chicken nugget	0.1
	salad	0.0
	coffee	0.1
	Total	4.2
	melon-cake bread	36.0
	cheeze bread	21.4
	fish sausage	11.3
	salad	0.0
	coffee	1.0
	Total	69.7

Figure 1: breakfast samples with carbo amount.

In summary, LCD has been one of the dietary measures with a history of over 100 years [14]. It has been actually applied to patients with diabetes and also convulsions for long associated with recognition of clinical effects [15]. Therefore, preclinical studies for its safety would be not required. Although some opinions are concerned about the long-term safety of LCD, no adverse events due to persistent LCD or elevated ketone levels have not been reported. In other words, it is not meaningful to examine negative phenomena using animal experiments such as rodents. Less carbohydrate amount in breakfast contributes less post-prandial blood glucose elevation. Consequently, this article will hopefully become a useful reference for clinical diabetic research in the future.

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