The Relationship between Socio-Demographic Characteristics, Clinical Characteristics, Self-Management, and Knowledge of Carbohydrate Portion in Type 2 Diabetes Patients
ความสัมพันธ์ระหว่างลักษณะทางประชากรศาสตร์ ลักษณะทางคลินิก การดูแลตนเองและความรู้ในเรื่องสัดส่วนคาร์โบไฮเดรต ในผู้ป่วยเบาหวานชนิดที่สอง

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ABSTRACT

This cross-sectional study aims to identify factors which related to knowledge of carbohydrate portion. The study was conducted in 135 of type 2 diabetes patients at King Chulalongkorn Memorial Hospital. The data which consist of socio-demographic characteristics, self-management, test of general diabetes knowledge and carbohydrate portion knowledge, were collected by interview. While, the required clinical information was obtained later from medical record. It was shown in the result that about 50 percent of participants had good glycemic control, which is related to their score of carbohydrate portion knowledge. And, the participants' score of carbohydrate portion knowledge is related to the participants' age, educational level, income, and their self-monitoring of blood glucose. The finding indicates that it may be useful to create a specific diabetes educational program for people with low diabetes knowledge.

บทคัดย่อ

การศึกษาแบบตัดขวางนี้ มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่มีผลต่อความรู้ในเรื่องสัดส่วนคาร์โบไฮเดรต กลุ่มตัวอย่างเป็นผู้ป่วยเบาหวานชนิดที่สองของโรงพยาบาลจุฬาลงกรณ์จำนวน 135 คน การเก็บข้อมูลประกอบด้วย ลักษณะทางประชากรศาสตร์ การดูแลตนเอง และแบบทดสอบความรู้ทั่วไปเรื่องเบาหวานและความรู้เรื่องสัดส่วนคาร์โบไฮเดรต โดยใช้การสอบถามจากผู้ป่วย จากนั้นจึงเก็บข้อมูลทางคลินิกจากแฟ้มประวัติของผู้เข้าร่วมวิจัย ผลการศึกษาพบว่า ผู้เข้าร่วมวิจัยประมาณร้อยละ 50 มีการควบคุมระดับน้ำตาลในเลือดอยู่ในเกณฑ์ดี ซึ่งเกี่ยวข้องกับคะแนนความรู้เรื่องสัดส่วนคาร์โบไฮเดรต ส่วนปัจจัยที่มีผลต่อความรู้เรื่องสัดส่วนคาร์โบไฮเดรต ได้แก่ อายุ ระดับการศึกษา รายได้และการตรวจวัดระดับน้ำตาลในเลือดด้วยตนเอง จากข้อมูลที่ได้จากการศึกษาในครั้งนี้ จะเป็นประโยชน์ในการสร้างโปรแกรมการให้ความรู้เรื่องเบาหวานที่มีความเหมาะสมต่อผู้มีระดับความรู้เรื่องเบาหวานน้อย

Keywords: Type 2 diabetes, Knowledge, Carbohydrate portion
คำสำคัญ: เบาหวานชนิดที่สอง ความรู้ สัดส่วนคาร์โบไฮเดรต

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Introduction

Diabetes mellitus is one of the fastest growing health problems in the world. It is a chronic disease which has main problem with carbohydrate metabolism (Handelsman et al., 2015). The three major pillars of diabetes treatments are medication, physical activity, and healthy eating. All of them require a self-management in patients (American Diabetes Association, 2015). Some of the people with diabetes had an education about self-management, but their blood glucose levels are still uncontrolled. The previous study evaluated a relationship between eating habit and glycemic control by a food frequency questionnaire. However, the result indicated that the participants actually had some diabetes knowledge of how to select a good food choice, but still being confused about a proper amount of food (Lerdsrimongkol, 2007).

In western countries, many studies about nutritional diabetes knowledge which being conducted, focused more on protein and fat, due to the composition of their foods (Carrera-Bastos et al., 2011). While, it is different from Thai cuisine, as Thai people normally consume carbohydrate-rich foods, due to the main ingredient of Thai foods is rice (Sowattanangoon et al., 2009). This is a reason why most educators in Thailand start diabetes educational program with carbohydrate portion (Arora et al., 2015). Carbohydrate counting is a method of estimating amount of carbohydrate in foods. It is generally used by people with diabetes because it is very flexible to create their meal plans (Gillespie et al., 1998). Although carbohydrate counting is a useful method, it is needed knowledge of carbohydrate portion. The food source and amount of carbohydrate are very important to design a healthy meal plan (Oliver, 2011). Carbohydrate is converted to glucose and affect blood glucose level within about 2 hours after eating (Sheard et al., 2004). The proper amount of carbohydrate at each meal helps to maintain blood glucose levels in targeted range (Kulkarni, 2005).

The previous studies in Thai people with type 2 diabetes conducted only general knowledge of diabetes such as characteristics of diabetes, blood glucose monitoring, diabetic symptoms and complications (Lorga et al., 2012). However, there were only a few studies that evaluated knowledge of carbohydrate portion, even carbohydrate is a nutrition that directly affects blood glucose level. Therefore, this study aims to evaluate knowledge of carbohydrate portion in type 2 diabetes patients, as it may help to improve diabetes educational program in the future.

Study Objective

To determine a relationship between socio-demographic characteristics, clinical characteristics, self-management, and knowledge of carbohydrate portion in type 2 diabetes patients.

Methodology

Development of test of carbohydrate portion knowledge

The test was developed by based on literature review. The content was identified by nutrition recommendation, basic carbohydrate counting, and misunderstanding about nutritional diabetes knowledge from previous studies. The first version contained 50 items. The content validity was tested by Index of Item-Objective Congruence (IOC). The items were evaluated by 4 experts. The score for each item was $\geq$ 0.5 and the unclear words were revised according to

experts' suggestion. The 4 items were rejected in this part. All questions were asked and ensured clarity by 10 patients with type 2 diabetes. After the patients read questions, they were asked to restate them with their own words. The test was examined index of discrimination in 30 patients with type 2 diabetes. The discrimination index of each item was at least 0.2. The 17 items were deleted due to poor discrimination power. Finally, the latest version contained 29 items. The reliability coefficient of this version was 0.827 as calculated by Kuder-Richardson (KR20) (Bichi, 2015). The final version contained 29 items as followings: general knowledge of diabetes diet (6 items); carbohydrate portion control (23 items); types of foods that contain carbohydrate (12 items); sugar-sweetened beverages (5 items); amount of carbohydrate in foods (4 items); and usage of nutrition facts label (2 items).

Study design and population

This study was a cross-sectional trial, which had been approved by the institutional ethic committee of the Faculty of Medicine, Chulalongkorn University. All participants agreed to provide complete informed consent. 135 participants, aged more than 20 years old, who were diagnosed with type 2 diabetes, were recruited from the diabetic clinic at Phor Por Ror Building, King Chulalongkorn Memorial Hospital. Participants were excluded if they had hemolytic anemia; blood loss or blood transfusion within 3 months; hospitalized within 3 months; pregnancy; steroid therapy; cancer; HIV infection; Stage 4-5 of chronic kidney disease, and cognitive problem.

Data collection

The data collection forms consist of 4 parts as follows:

Part 1 socio-demographic characteristics include gender, age, education level, marital status, people who you live with, income, diabetes duration.

Part 2 self-management information include self-monitoring of blood glucose, exercise, education about healthy diet for diabetes.

Part 3 test of general diabetes knowledge was developed by Wongwiwatthananukit et al. (2004). It consists of 21 True-False questions and the questions include 5 topics of diabetes knowledge (general characteristics of diabetes, diet control, exercise, medication, sick-day management) (Wongwiwatthananukit et al., 2004).

Part 4 test of carbohydrate portion knowledge as developed and described above. First section include 6 True-False questions about general knowledge of diabetes diet. Second section consist of 4 components. The first component contains list of 12 types of food and the question is "Is it a food source of carbohydrate?" The second component contains 5 kinds of beverage and the question is "Is it a sugar-sweetened beverages?" The third component contains 4 multiple choice questions. The participants were asked to compare 2 different types and amount of food. The question is "Which one contains more amount of carbohydrate or both equal?" Last component contains 2 examples of nutrition facts label and ask participants to calculate amount of carbohydrate in the food.

The data was obtained from participants by interviewing in person within 45 minutes. After interview, the most recent documented HbA1C, weight change, and hypoglycemia events would be obtained from medical record.

Data analysis

Descriptive statistics explained knowledge score of general diabetes, knowledge score of carbohydrate portion, socio-demographic characteristics, clinical characteristics, and self-management information. All data were expressed as

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mean ± standard error of the mean (SEM) and percentage. Analytical statistics described a relationship between variables. Firstly, Spearman's rank correlation would be used to test association between score of general diabetes knowledge and score of carbohydrate portion knowledge. Secondly, Independent t-test and ANOVA would be used to analyze a relationship between score of carbohydrate portion knowledge and participants' characteristics. Statistical significance was set at $\alpha < 0.05$ for 2 tailed test. If p-value were less than 0.05, it would be accepted as statistically significant. The statistical analysis was performed by using SPSS version 22 for windows.

Results

A total of 135 participants completed 2 knowledge tests. As shown in Table 1, mean score of general diabetes knowledge was 16.32 (SEM = 0.28). The minimum was 3 and the maximum was full score (21 points). For test of carbohydrate portion knowledge, mean with SEM was 16.24 ± 0.34. The minimum and maximum score were 4, 25 respectively. From percentage of mean score, the participants did higher score on test of general diabetes knowledge than test of carbohydrate portion knowledge. As test of carbohydrate portion knowledge, the participants scored less than 50 % on 2 parts. Usage of nutrition facts label and amount of carbohydrate in foods were scored 23.50%, 42.00% respectively.

Table 1 Descriptive statistics of score of general diabetes knowledge and carbohydrate portion knowledge

Characteristics	Full score	Mean ± SEM[1]	%	Min	Max
1. Knowledge of general diabetes	21	16.32 ± 0.28	77.71	3	21
2. Knowledge of carbohydrate portion	29	16.24 ± 0.34	56.00	4	25
2.1 General knowledge of diabetes diet	6	4.01 ± 0.09	66.83	0	6
2.2 Carbohydrate portion control	23	12.24 ± 0.30	53.22	0	19
2.2.1 Types of foods that contain carbohydrate	12	7.06 ± 0.18	58.83	0	12
2.2.2 Sugar-sweetened beverages	5	3.03 ± 0.11	60.60	0	5
2.2.3 Amount of carbohydrate in foods	4	1.68 ± 0.08	42.00	0	4
2.2.4 Usage of nutrition facts label	2	0.47 ± 0.05	23.50	0	2

[1] SEM : Standard error of the mean

Table 2 Correlations for score of general diabetes knowledge and carbohydrate portion knowledge

Characteristics	Knowledge of general diabetes	P-value
1. Knowledge of carbohydrate portion	0.351	<0.001*
1.1 General knowledge of diabetes diet	0.329	<0.001*
1.2 Carbohydrate portion control	0.292	0.001*

Correlations are Spearman's rank correlation and significant correlations at P-value <0.05.

Moreover, test of general diabetes knowledge significantly related to test of carbohydrate portion knowledge (R = 0.351, p-value = <0.001). In addition, both parts of carbohydrate portion knowledge statistically associated with knowledge of general diabetes (Table 2).

Table 3 Demographic characteristics and relationship with score of carbohydrate portion knowledge

Characteristics		N	%	CP score[3]	P-value
Gender[1]	Male	42	31.11	16.30 ± 0.62	0.898
	Female	93	68.89	16.22 ± 0.41	
Age (years)[1]	Less than 60 years	47	34.81	17.57 ± 0.49	0.004*
	More than 60 years	88	65.19	15.53 ± 0.43	
Education level[1]	Lower than diploma	57	42.22	14.88 ± 0.48	<0.001*
	Diploma and higher	78	57.78	17.24 ± 0.44	
Marital status[2]	Single	22	16.30	15.91 ± 0.65	0.924
	Married	90	66.67	16.41 ± 0.43	
	Divorced	4	2.96	16.00 ± 2.04	
	Widowed	19	14.07	15.89 ± 1.05	
People who you live with[2]	Living with parents, spouse and children	9	6.67	18.44 ± 1.51	0.305
	Living with spouse and children	64	47.41	16.52 ± 0.49	
	Living with children	30	22.22	15.36 ± 0.62	
	Living with sibling	18	13.33	15.83 ± 0.67	
	Living alone	14	10.37	16.00 ± 1.50	
Income[2]	No income	48	35.55	14.52 ± 0.51[a]	<0.001*
	Less than 15,000 baht per month	29	21.48	15.24 ± 0.72[a]	
	15,001 to 25,000 baht per month	34	25.19	17.50 ± 0.59[b]	
	More than 25,000 baht per month	24	17.78	19.13 ± 0.66[b]	
Diabetes duration[2]	Less than 1 year	2	1.48	18.00 ± 2.00	0.076
	1 to 5 years	17	12.59	15.00 ± 0.74	
	5 to 10 years	26	19.26	17.85 ± 0.78	
	More than 10 years	90	66.67	15.98 ± 0.42	

*statistically significant as P-value <0.05

[1]Independent t-test [2]One-way ANOVA with post-hoc Tukey test

[3]CP score: Score of carbohydrate portion knowledge express as mean ± standard error of the mean

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Table 4 Self-management, clinical characteristics and relationship with score of carbohydrate portion knowledge

Characteristics		N	%	CP score[3]	P-value
Other underlying diseases[2]	No	20	14.81	17.85 ± 1.01	0.226
	DLP[4] only	13	9.63	15.23 ± 0.54	
	HTN[5] and DLP[4]	86	63.70	16.24 ± 0.43	
	CKD[6] stage 3 with HTN[5] and DLP[4]	9	6.67	14.89 ± 1.59	
	CVD[7] with HTN[5] and DLP[4]	7	5.19	15.29 ± 1.06	
Treatment[2]	Diet control	6	4.44	18.17 ± 1.25	0.380
	Oral medication only	80	59.26	16.34 ± 0.47	
	Insulin injection	49	36.30	15.86 ± 0.51	
Self-Monitoring of Blood Glucose[1]	Do not have glucose meter	57	42.22	15.44 ± 0.57	0.042*
	Having glucose meter	78	57.78	16.83 ± 0.41	
Exercise more than 150 minutes per week[1]	No	97	71.85	15.96 ± 0.40	0.179
	Yes	38	28.15	16.97 ± 0.65	
Education about healthy diet for diabetes[2]	No	0	0.00	-	-
	Yes	135	100.00	-	
HbA1C (%)[1]	≤ 7.0	64	47.41	17.44 ± 0.46	0.001*
	> 7.0	71	52.59	15.17 ± 0.46	
Weight change[2]	No	126	93.34	16.27 ± 0.34	0.069
	Increase □ 5%	4	2.96	19.25 ± 2.29	
	Decrease □ 5%	5	3.70	13.20 ± 1.88	
Hypoglycemia[1]	No	126	93.33	16.84 ± 0.36	0.496
	Yes	9	6.67	17.11 ± 0.87	

*statistically significant as P-value <0.05

[1]Independent t-test [2]One-way ANOVA with post-hoc Tukey test

[3]CP score: Score of carbohydrate portion knowledge express as mean $\pm$ standard error of the mean

[4]DLP: Dyslipidemia [5]HTN: Hypertension [6]CKD: Chronic kidney disease [7]CVD: Cardiovascular disease

Demographic characteristics of participants was as explained in Table 3. 68.89 percent of participants were female. Two-thirds of participants (65.19 %) were older than 60 years. Almost 60 percent had diploma or higher education. Over 60 percent of participants were married and most of them lived with spouse and children. Only 10.37 percent of participants lived alone. More than 30 percent did not receive any income. The majority of participants had diabetes for more than 10 years (66.67%).

Most of participants had other underlying diseases while only 20 participants (14.81%) had not. Almost 60 percent of the sample used oral medication only for treatment. More than half of participants had glucose meter. Only 39 participants (28.89%) exercised more than 150 minutes per week. All participants received diabetes education about healthy diet. About half of participants had good control of blood glucose level (HbA1C $\leq$ 7.0 %). More than 90 percent of participants had no weight change. Only 17 participants (6.67%) had hypoglycemia (Table 4).

The factors that related to knowledge of carbohydrate portion were age, educational level, income, self-monitoring of blood glucose, and HbA1C. The participants who aged less than 60 years had the higher score. The lower educational level associated with less knowledge of carbohydrate portion. The groups that received income more than 15,000 baht per month earned the better score. The participants who did not have glucose meter scored less than the group that had. The participants with good glycemic control had the better score of carbohydrate portion knowledge.

Discussion and Conclusions

Self-management is the way to control blood glucose level. The knowledge about healthy diet is necessary in order to select a good food choice and to estimate an amount of foods. According to the result of this study, knowledge of carbohydrate portion was statistically related to glycemic control. Similarly, previous study indicated that blood glucose level associated with diabetes knowledge (Al-Qazaz et al., 2011). In addition, diabetes knowledge may impact to the better eating behavior (Marcy et al., 2011).

The results showed that all participants received diabetes education about healthy diet, but only half of them had good glycemic control. There may be other factors that affect patients' understanding. In this study, the younger participants significantly had the better knowledge than the older participants. It is agreed with other studies that found the same result (Saleh et al., 2012; Nam et al., 2011). However, some studies argued that the older participants had the higher level of knowledge (Hu et al., 2013; Pongmesa et al., 2009). In addition, the educational level may affect knowledge as explained by the result of Kim et al. It indicated that people with the lower educational level had less awareness of diabetes (Kim et al., 2015). Moreover, the participants with good literacy were more easily understand new information than the poor one (Bains et al., 2011).

Additionally, previous studies showed that eating behavior associated with household income. High income family had more opportunity to buy more variety of foods (Seligman et al., 2012). Thus, this may affect to an attention about diabetes education. The people who had good income were interested in how to select a good food choice (Deepa et al., 2014). Many studies demonstrated that self-monitoring blood glucose helped type 2 diabetes patients to have good glycemic control and healthy lifestyle (Malanda et al., 2012; Polonsky et al., 2011; Al-Khawaldeh et al., 2012). Moreover, previous study found self-monitoring blood glucose associated with the higher knowledge. The researchers reported that it was easy to understand about diabetes knowledge with performance of self-monitoring blood glucose (Franciosi et al., 2011).

The primary barrier of self-management is lack of knowledge (Kisokanth et al., 2013). The result of this study showed that participants had problem with calculating nutrition facts label and estimating amount of

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carbohydrate. Previous studies indicated deficits in understanding nutrition labels. Literacy and numerical skills was highly correlated with correct interpretation, but even people with average literacy might have difficulty of calculating carbohydrate from nutrition facts label (Cha et al., 2014). In addition, inaccurate carbohydrate estimation is related to uncontrolled blood glucose level, especially patients on insulin (Brazeau et al., 2013).

In conclusion, health care professionals usually provide diabetes education as instructors and follow the standard program of their hospital (Haas et al., 2012). This study demonstrated that some groups of type 2 diabetes patients may need tailored diabetes education or adjusted the way of knowledge delivery.

Acknowledgements

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