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ResearchArticle

DEVELOPMENT OF NEW NUTRITION EDUCATION TOOL USING CARBOHYDRATE COUNTING FOR THAI CHILDREN WITH TYPE 1DIABETES

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ABSTRACT

Understanding on carbohydrate counting is a good way to improve glycemic control in children with type 1 diabetes. A suitable nutrition education tool for children with type 1 diabetes is an alternative tool to help children learn how to counting carbohydrate and gain his/her knowledge. Thai children with type 1 diabetes have problems on managing glycemic levels and they rarely have effectiveness nutrition education tool. The objective of this study was to develop a new nutrition education tool using carbohydrate counting for Thai children with type 1 diabetes. In phase I, we reviewed and collected information, and interviewed children with type 1 diabetes. We wrote contents and created education tool. In phase II, the tool was evaluated by 15 diabetes educators. The results of the study showed the new nutrition education tool using the carbohydrate counting concept was created and it was accepted by diabetes educators. The developed tool was an alternative choice to educate children with type 1 diabetes.

INTRODUCTION

Type 1 diabetes is a non-communicable chronic disease that can be found in children and adolescents (:http://www.diabetes.org/diabetes-basics/type-1/.).The global incidence of type 1 diabetes is increasing 3% every year (Patterson *et al*., 2013). The incidence of children with type 1 diabetes in Thailand was 1.66/100000 per year, and nearly by the incidence of others countries in Asia (Tuchinda *et al*., 1992; Likitmaskul *et al*., 2006). It is caused by an inflammatory destruction of the beta cells of the pancreas, leading to an essentially complete loss of the ability to synthesize and release insulin, therefore type 1 diabetes patients needs insulin injections through their life (Cryer, 1999).The patient who could not maintain their glycemic control may cause an acute and chronic diabetic complications (Tambolane and Ahern, 1997). However, the patients may delay the complication progress by taking care of their diabetes.

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Treatment of type 1 diabetes requires insulin therapy and diet control. Medical nutrition therapy helps them to achieve a target glycemic control and have a normal growth (American Diabetes Association, 2001).Nutrition recommendation for children with type 1 diabetes should focus on achieving blood glucose target that maintains normal growth and development without excessive hypoglycemia (American Diabetes Association, 2002). Food and nutrition are directly affecting their glycemic control, especially for carbohydrate that is an important nutrient for children's body (American Diabetes Association, 2009; Kawamura, 2007). This can be accomplished through individualized food and their nutritional knowledge. Carbohydrate counting can be used in conjunction with a meal plan to set carbohydrate targets at each meal and snack. Carbohydrate counting is also used, perhaps more commonly, to estimate carbohydrate intake and adjust insulin mixed meals and snacks using insulin to carbohydrate ratio. The effectiveness of carbohydrate counting addresses the variable eating habits for most children. Carbohydrate counting can make food flexible and enjoyable for children with type 1 diabetes. Moreover, the meal planning approach is important for the physical growth and psychological development of children with diabetes (Kawamura, 2007; Silverstein, 2005).

An appropriate nutrition education tool for children with type 1 diabetes is an alternative way to prevent later complications and promoting a healthy living (American Diabetes Association, 2009; Aoki *et al*., 2004).However, type 1 diabetes educators are not always available in Thailand.Previously, we were interviewed patient needs, current situations in Thailand and the environment of patients in order to identify the proper nutrition education tools. We found that Thai children with type 1 diabetes have problems to manage their glycemic control and counting carbohydrate knowledge that will lead to misunderstanding carbohydrate choices (http://www.thaidiabetes.com/.).Moreover, some of them come back to the hospital again and again. They could not control their blood glucose levels because they did not know how much they could eat. In addition, there are only few nutrition educational tools available for Thai children with type 1 diabetes (Deerochanawong and Ferrario, 2013). Accordingly, we have developed the new nutrition education tool using carbohydrate counting thatbenefits to childhood type 1 diabetes. Furthermore, we evaluated the tool in terms of usefulness and appropriateness for children with type 1 diabetes.

METHODS

Phase I: Development of new nutrition education tool

Step 1 reviewed information

We reviewed and collected information about nutrition education tools for children with type 1 diabetes, from reliable sources such as journal articles, textbooks and related researches. In addition, we interviewed and focused on group discussions with type 1 diabetes patients in hospital to collect some valuable suggestions.

Step 2: wrote content

Content was revised from reliable resources such as paper-reviewed, scientific journals, journal articles, reliable websites, books, information via problem-based learning and small focused groups. In addition, all the ideas have been discussed with our diabetes healthcare team to make sure that the contents were appropriate for children.

Step 3 created Storyboard

We transformed all of the content to storyboard by manually drawing. The concept of the story is activities between 2 main characters. The first is a nutritionist with long hair and wearingglasses, her name is Nu-C. The second is a child with type 1 diabetes and his name is Khao-Phan.

Step 4 created nutrition education tool

The tool was included; videos, practices and examination games. The processes of constructing the tool was transformed storyboards to infographics.

Phase II Evaluated the effectiveness of nutrition education tool by diabetes educators

A total of 15 diabetes educators was included; doctors, nurses, nutritionists and diabetes professionals evaluated the tool.

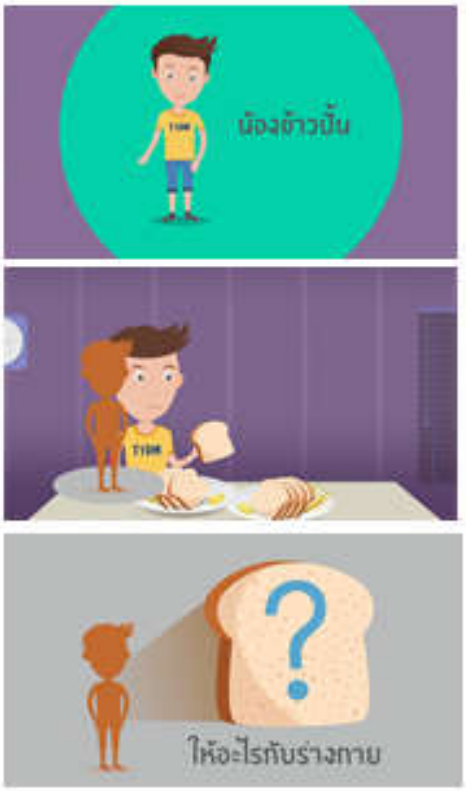

Figure 1. An example of infographics

All educators were received a questionnaire in order to evaluate the designs, usefulness and acceptability of developed tool. The questionnaire was categorized into 4 topics included;

- Contents
- Arts and designs
- Usability
- Acceptability

The questionnaire contained 11 questions with a scale of satisfaction of the tool from 1 to 5 (5 = extremely satisfied, 4 = very satisfied, 3 = moderate satisfied, 2 = less satisfied, 1= Very less satisfied) Moreover, we provided a comment box for additional comments to develop our tool continuously.

RESULTS

We developed the new nutrition education tool using carbohydrate counting which provided nutritional knowledge to children with type 1 diabetes. Six nutrition education videos, practices, and examination games were created. The story includes; Introduction to carbohydrates, where do we get carbohydrates from, how to count carbohydrate, food record for people who count carbohydrate, reading and understanding food labels, and healthy eating guide for children.

Description of each lesson

Lesson 1: Introduction to carbohydrates

Carbohydrates are the macro nutrients that we need in the largest amounts. According to dietary reference Intakes published by the USDA, 45% - 65% of calories should come from carbohydrates.

Table 1. Questionnaire used in evaluated the effectiveness of developed tool by diabetes educators

Topics	Question about
Contents	1. Length of content
	2. Content is easy to understand
	3. An appropriation of sequence
Arts and designs	4. The picture is nearly by natural
	5. The sound effect is clear
	6. An appropriation of color and font size
	7. An appropriation of composition
Usability	8. The tool is easy to access
	9. Menu of the tool are easy to use
Acceptability	10. It is interesting tool
	11. The tool is suitability for children with type 1 diabetes

Carbohydrates are found in most of the food that a child eats. It is a major nutrient which supplies blood glucose levels in a child's body and brain, especially children with type 1 diabetes. After a child's meal, the carbohydrates from the food they consumed are broken down into smaller units of sugar. These small units get absorbed out of their digestive tract and into their bloodstream. This blood glucose is transported through their blood stream to supply energy to their muscles and other tissues. This is an important process for children's growth and development. Therefore, in lesson 1 they will learn what is carbohydrate and how it works. Moreover, a child's brain must have the amount of glucose to develop, to learn and respond to everyday life.

Figure 2. Introduction to carbohydrates

Lesson 2: Where do we get our carbohydrate from?

Carbohydrates are found in most of the food like rice, grains, fruits, milk products and vegetables. This lesson provided a source of carbohydrates in various foods. Some children with type 1 diabetes, lack of knowledge about which food has carbohydrate or how many carbohydrates in each food. In this lesson we provided them. The tools were explained through food groups, calories, and portion size.

Figure 3. Where do we get our carbohydrate from?

Lesson 3: How to count carbohydrate

After they know the basics of carbohydrates, we began to introduce how to count carbohydrates. Carbohydrate counting is a good way to maintain glycemic for type 1 diabetes. Once you learn how to count carbohydrate, you'll find it easy to fit a wide variety of food into your meal plan, including combinations of food such as those in frozen dinners (http://www.joslin.org/info/Carbohydrate_Counting_101.html).

Another benefit of counting carbohydrates is that it can bring tighter control over your glucose readings. Being as precise as possible with your carbohydrate intake and medications will help you better manage your blood glucose after meals. In this lesson, they will learn how to identify the portion size and how to count the food that they eat.

Lesson 4: Food record for people who count carbohydrate

In this lesson, we provided how to record the food which includes meal time, menu, ingredients, serving size.

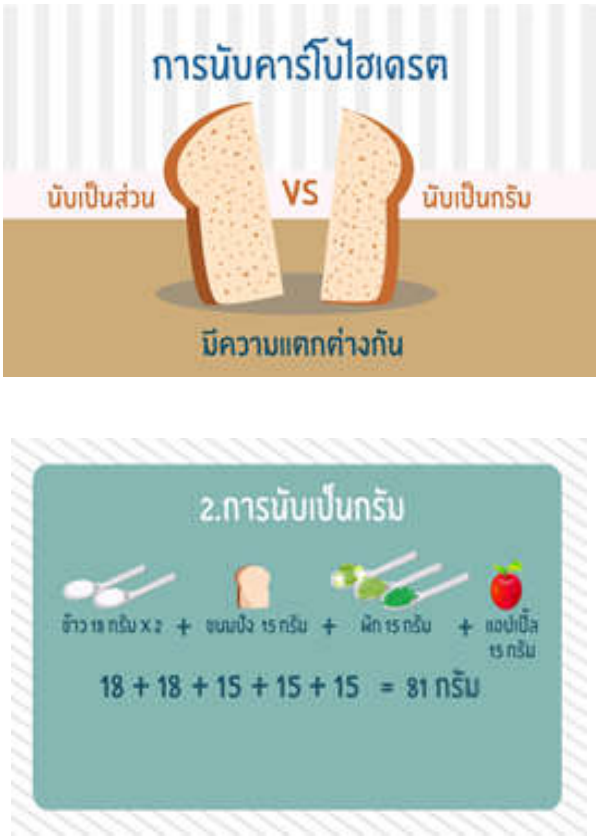

Figure 4. How to count carbohydrate

To measure how much they can eat, use a set of easy measuring tools that can be found in the kitchen like a spoon, tablespoon, teaspoon, or a glass of water to help estimate the amounts. Even, learn how to estimate portion size when a child is not at home. Actually, many children with type 1diabetes already know how to record their food, but the right, good and quality food records are helping them to estimate carbohydrates.

Figure 5. Food record for person who count carbohydrate

Lesson 5: Reading and understanding food labels

This lesson provides how to read nutrition labels. The child needs to know what and how much they should eat. For example, by checking the grams of the total carbohydrates on each of the Nutritional Facts label on a snack pouch, you can figure out how to fit the in-between-meals into your carbohydrate allotment with a particular meal. Moreover, we have provided the knowledge about how to choose a good food by seeing the nutritional facts.

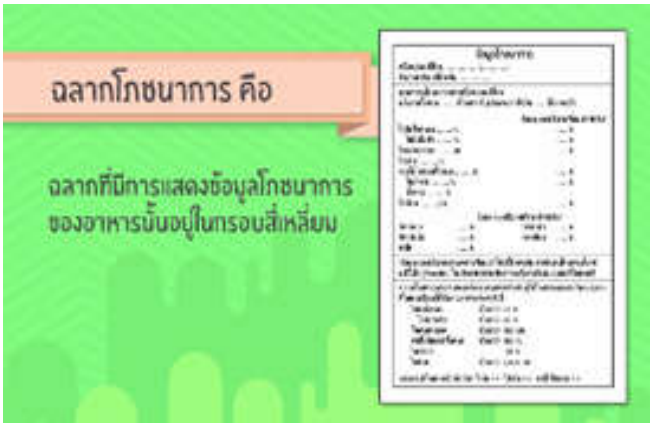

Figure 6. Reading and understanding food labels

Lesson 6: Healthy eating guide for children

A healthy eating habit is an important for children, not only in children with type 1 diabetes but also in a normal child. Our body and brain have to grow and develop by eating healthy food so it is valuable to learn about healthy eating habits.

Figure 7 – Healthy eating guide for children

In addition, at the end of each lesson the child can test their knowledge with practices and examination games.

Result of phase II Evaluated the effectiveness of nutrition education tool by diabetes educators

Diabetes educators were interesting in the tool with extremely satisfied in every chapter. Moreover, they were extremely satisfied in suitability for children with type 1 diabetes topic with more than 80% in chapter4, more than 70% in chapter 1,6 and more than 60% in chapter 2,3 and 5.

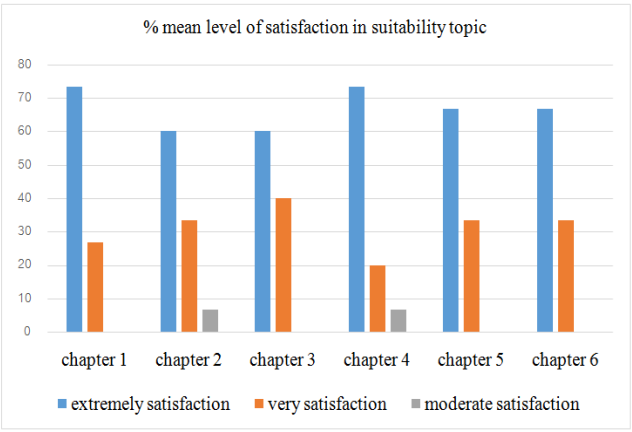

Chart 1. Percent mean level of satisfaction in suitability topic

DISCUSSION

The anticipation of the authors was to provide a healthy way for children with type 1 diabetes. We wish that they will enjoyable and flexible their food. We developed 6 nutrition education videos, practices and examination games for children with type 1 diabetes, which related to carbohydrate counting and the activities. The results from diabetes educators were shown that the tool was interesting and it was accepted by diabetes educators that similarly to the result from other development tools.

However, this tool was not provided about self-monitoring blood glucose that we may make it in future study. The tool was an optional to educate children with type 1 diabetes in Thailand which not has too much nutrition education tools available. However, this is not the only one way to maintain glycemic levels but also diabetic self-management, environmental and supporting team arestill important to children with type 1 diabetes too.

Conclusion

The new nutritional education tool could be an alternative choice for integrated knowledge of carbohydrate counting for children with type 1 diabetes. However, it need to evaluate an effectiveness and clinical outcomes in children with type 1 diabetes.

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