DEVELOPMENT OF MYANMAR CARBOHYDRATE COUNTING BOOKLET

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ABSTRACT

Background: Diabetes mellitus is one of the major challenging problems in Myanmar. Even with its high occurrence, the prevalence of good glycemic control was relatively low. According to Myanmar food culture, most of the foods that Myanmar people daily consumed are carbohydrate-based. Therefore, a nutrition education tool that can raise the awareness of amount of carbohydrate in foods and provide scientific but comprehensible dietary information about carbohydrate counting is necessary in all arenas to combat diabetes: prevention, promotion and management.

Aim: The aim of this study was to develop Myanmar carbohydrate counting booklet.

Method: The first phase developed the booklet and then the acceptance of the booklet was assessed in the second phase by an experimental study.

Results: In the first phase, the booklet named "Basic Carb Counting for People Living with DM" was developed. It was $14.5 \times 20.5 \times 1$ cm in size and of 103 pages. It contained illustrated facts and information about diabetes, about basic carb counting and carb choices of different food items along with respective food photographs. In the second phase, 36 people with diabetes participated in the study with the mean age of 48.4 ± 10.7 years, 47.2% of male and 52.8% of female. The results showed that the knowledge score of diabetes, carbohydrate and total scores increased significantly ($p < 0.05$) between pre-test score and post-test score. The participants' satisfaction level with the newly developed booklet was somewhere between "very satisfied" to "extremely satisfied" giving the mean and median responses of between 5 and 6 on a 6-point Likert scale.

Conclusion: The developed carbohydrate counting booklet was accepted by people with diabetes in Myanmar and the contents in the booklet were understandable to witness the improvement in the knowledge of the disease and basic carbohydrate counting concept as well.

Keywords: Diabetes mellitus, carbohydrate counting, nutrition education tool

INTRODUCTION

Diabetes mellitus (DM) is becoming one of the most challenging health problems in the 21st century. Year by year, its prevalence is estimated to be in the rising trend globally. According to International Diabetes Federation (IDF), the national prevalence of DM in Myanmar was projected to be 6.5% and about 2,172,900 people were living with DM in 2015 [1]. However, report on the national survey of DM and risk factors for non-communicable diseases in Myanmar (2014) documented that the DM prevalence in 25-65 years aged group is 10.5% which is even higher than that estimated by IDF [2].

Despite of its common occurrence, the prevalence of good glycemic control was quite low and is related to the low proportion of good self-care for diet [3]. Diet issue is one of the major challenges for diabetes care service in Myanmar. Myanmar people eat white rice as a staple food. Generally, around three-quarters of the daily intake of Myanmar people come from rice in all three meals. In addition to it, snacks and desserts that are mostly consumed by urban and rural dwellers are mainly made with rice or glutinous rice, both being rich sources of carbohydrate. Moreover, it is also pointed out that seasonal fruits also contribute to the poor glycemic control in DM patients [4].

It is evident that lack of awareness of amount of carbohydrate in foods and its relation to blood sugar level as well as mindfulness of portion size are the possible knowledge gap for DM patients in Myanmar. Thus, this study will fill this gap by providing scientific but comprehensible dietary information about carbohydrate counting coupled with developing portion-control skills in DM patients with the help of photographic educational booklet.

METHODS

This study was conducted in 2 phases. In phase 1, development of Myanmar carbohydrate counting booklet, the nutritive values of foods were calculated based on "nutritive values of Myanmar foods" published by Nutrition Research Unit of the Department of Medical Research and illustrative nutrient information for common foods in Myanmar published by Myanmar Society of Endocrinology and Metabolism (2014). The amount of carbohydrate in foods was counted as carb choices in table 1 and this is the method used in Carbohydrate Counting: The basics by American Dietetic Association [5].

Table 1. How to count carbohydrate for carb choices

Grams of carbohydrate	Count as
0 – 5 g	0 (do not count)
6 – 10 g	$\frac{1}{2}$ carb choice
11 – 20 g	1 carb choice
21 – 25 g	$1\frac{1}{2}$ carb choices
26 – 35 g	2 carb choices
36 – 40 g	$2\frac{1}{2}$ carb choices

Pictures of the measured foods were taken according to the standard procedures of taking food photographs and included in the booklet. Content validity of draft of the booklet was checked and approved by an expert team. In phase 2, an experimental study (a single group pre-test, post-test design) was conducted with 36 diabetic patients from diabetic clinic in Mandalay, Myanmar to assess the understanding and acceptability of the booklet. Purposive sampling technique was used. Thirty-six participants who met inclusion criteria (all types of DM patients without serious complications, age 25-65 years old, both male and female, those who are able to read and write) were enrolled by self-selection to voluntarily participate in the study. Questionnaire for general characteristics, pre-test, post-test questionnaire and satisfactory questionnaire were used for data collection.

All the statistical analysis was done by using the Statistical Package for the Social Science software (IBM SPSS software version 20) and p-value less than 0.05 was considered as statistical significant. The personal information and anthropometric measurements of the participants were analyzed by using appropriate descriptive statistics such as mean and standard deviation or number and percentage. Paired t-test was used to compare the score of the participants' knowledge and understanding of diabetes and carbohydrate between pre-test and post-test. Analysis of covariance (ANCOVA) was used to compare the post-test scores based on their background characteristics. The evaluation of the booklet was described as percentage, mean, standard deviation, median and minimum-maximum.

RESULTS

The newly developed booklet was named as "Basic Carb Counting for People Living with DM" and composed of 103 pages. The dimension of the booklet was $14.5 \times 20.5 \times 1$ cm. Since it was meant for Myanmar people, Myanmar language was used as a medium. It covered the following topics: 1) Introduction; Chapter (1) About diabetes; Chapter (2) Basic knowledge about food groups and nutrients; Chapter (3) About basic carb counting; Chapter (4) Carb choice of each food items in different groups; Chapter (5) How to make the right choices?; Conclusion; References.

Figure 1 Cover page of the booklet

Figure 2 Some food items in the booklet
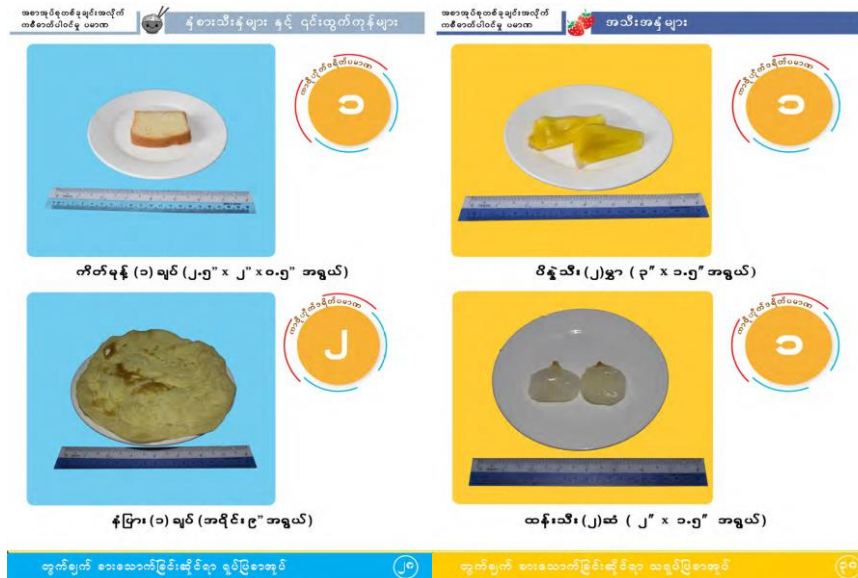
Then the phase 2 of the study was conducted in Mandalay, Myanmar with 36 participants. Of all the total participants, there was nearly equal number of male and female (17 and 19 respectively). Nearly 60% of them were 46-65 years. Only approximately one-third was graduates (Table 2).

Table 2 Socio-demographic characteristics (n=36)

Variable	Number	Percentage
Gender		
Male	17	47.2
Female	19	52.8
Age Group (years)		
25-35	5	13.9
36-45	9	25
46-55	12	33.3
56-65	10	27.8
Mean (SD)	48.44 (10.72)	
Range (Min-Max)	27 - 65	
Education Level		
High school or lower	20	55.6
University or diploma	4	11.1
Bachelor's degree or higher	12	33.3

Most of the study participants were type 2 diabetic and had disease for the duration of 6 months to 3 years. For the co-morbidities, 61.1% of participants have co-morbidities. Of all co-morbidities, hypertension was the most common co-morbid disease among these 36 participants, 38.9% (Table 3).

Table 3 Diabetes status of 36 participants

Variable	Number	Percentage
Type of diabetes		
Type 1 DM	2	5.6
Type 2 DM	34	94.4
Diabetes Duration		
< 6 months	7	19.4
6 months – 3 years	14	38.9
3-5 years	7	19.4
5-10 years	6	16.7
>10 years	2	5.6
Co-morbidities		
Hypertension	14	38.9
Heart disease	4	11.1
Liver disease	2	5.6
More than one disease	2	5.6
No co-morbidity	14	38.9

Approximately 50% of the participants did not meet the glycemic recommendation by American Diabetes Association (ADA) and most of those with higher cut-off value were men. Nearly two-thirds were obese in accordance with WHO criteria for Asian population (Table 4).

Table 4 Baseline nutritional status of the participants

Variable	Female (n = 19) n (%)	Male (n = 17) n (%)	Total (n = 36) n (%)
Peak postprandial capillary plasma glucose (mg/dl)			
Recommended level(≤180 mg/dl)	16 (84.2%)	2 (17.6%)	19 (52.8%)
Higher cut-off(.180 mg/dl)	3 (15.8%)	14 (82.4%)	17 (47.2%)
Mean ± SD	144 ± 47.2	237.9 ± 81.6	188.4 ± 80.3
Body mass index (kg/m^2)			
Underweight (<18.5)	0 (0%)	1 (5.9%)	1 (2.8%)
Normal (18.5 – 22.9)	6 (31.6%)	1 (5.9%)	7 (19.4%)
Overweight (23 – 24.9)	2 (10.5%)	3 (17.6%)	5 (13.9%)
Obese (>25)	11 (57.9%)	12 (70.6%)	23 (63.9%)
Mean ± SD	26.4 ± 5.1	26.8 ± 4.3	26.6 ± 4.7

The assessment of the participants' knowledge about the diabetes and carbohydrate was done by using pre-test, post-test questionnaire. The questionnaire consists of two parts. The first part includes 13 multiple choice questions with each question having four answers. The second part is true/false section and composed of 12 statements. The scoring system was to give 1 score for each correct answer and 0 for wrong or incomplete answers. Out of total 25 questions, 15 questions assessed the knowledge about diabetes and 10 questions were for basic knowledge about carbohydrate.

When the knowledge scores of pre-test and post-test were compared, the participants' knowledge was significantly increased. The significant increase in the knowledge score was observed in both diabetes knowledge test and carbohydrate knowledge test (Table 5).

Table 5 Comparison of the participants' pre-test and post-test knowledge score

Knowledge score	Pre-test Mean ± SD	Post-test Mean ± SD	t	p-value
General knowledge about DM	10.53 ± 2.12	13.11 ± 1.30	7.729	0.000
General knowledge about carbohydrate	6.42 ± 1.59	8.19 ± 1.17	6.303	0.000
Total knowledge score	16.94 ± 3.34	21.31 ± 1.70	8.760	0.000

After the participants have read the booklet and answered the post-test questionnaire, the mean scores of knowledge were not significantly different between different education levels (Table 6) and between male and female (Table 7). Therefore, and inference can be drawn that the contents in the booklet were understandable to participants with different education backgrounds, regardless of being male and female.

Table 6 Comparison of participants' post-test knowledge scores based on education level

Knowledge score	Education level	Mean ± SD	p-value
Diabetes knowledge	High school or lower (n = 20)	13.04 ± 0.30	
	University or diploma (n = 4)	12.55 ± 0.62	0.528[a]
	Bachelor's degree or higher (n = 12)	13.41 ± 0.42	
Carbohydrate knowledge	High school or lower (n = 20)	8.05 ± 0.27	
	University or diploma (n = 4)	8.74 ± 0.58	0.560[a]
	Bachelor's degree or higher (n = 12)	8.26 ± 0.36	
Total score	High school or lower (n = 20)	21.09 ± 0.39	
	University or diploma (n = 4)	21.29 ± 0.79	0.721[a]
	Bachelor's degree or higher (n = 12)	21.67 ± 0.53	

([a] ANCOVA, corrected for pre-test knowledge score)

Table 7 Comparison of participants' post-test knowledge scores based on gender

Knowledge score	Gender	Mean ± SD	p-value
Diabetes knowledge	Male (n = 17)	13.44 ± 0.29	1.38[a]
	Female (n = 19)	12.82 ± 0.28	
Carbohydrate knowledge	Male (n = 17)	8.26 ± 0.29	0.766[a]
	Female (n = 19)	8.14 ± 0.28	
Total score	Male (n = 17)	21.73 ± 0.38	0.143[a]
	Female (n = 19)	20.92 ± 0.36	

([a] ANCOVA, corrected for pre-test knowledge score)

At the end of the study, participants' satisfaction with the booklet was evaluated by using the satisfactory questionnaire. The questionnaire was designed to use a six point Likert scale in which 1 was meant for extremely dissatisfied, 2: very dissatisfied, 3: somewhat dissatisfied, 4: somewhat satisfied, 5: very satisfied and 6: extremely satisfied. None of the participants rated the education tool as unsatisfactory in any part of the booklet. It was found out that most of them rated the booklet as "very satisfied" to "extremely satisfied" .

DISCUSSION

In this study, the developed education tool was in the form of 14.5 cm × 20.5 cm × 1 cm sized booklet with 103 pages. In the previous similar study, the education tool was in the form of 2 booklets; one about diabetes and one about basic carb counting, both in the size of 13 cm × 20 cm consisting of 36 pages and 48 pages respectively [6]. This education tool combined the facts and information about diabetes mellitus and basic carbohydrate counting into one booklet to be more compact and for the purpose of users' convenience.

A previous study also developed education tool model using carbohydrate counting concept in the form of colorful comic books with photographic food cards. That study was aimed for the adolescent age-group with type 1 diabetes and so used cartoons and photographic food cards for carbohydrate counting games to attract and draw the attention of the study participants [7]. However, this study targeted adult population (25-65 years) and colorful food photographs and relevant illustrations were used.

This education booklet consists of total 111 food items in 7 different food groups. A previous study developed carbohydrate counting booklet for Bhutan people and it categorized foods into 8 different food groups including 105 food items in total [6]. Another similar education tool for adult Sri Lankan with diabetes used 51 food items in 4 separate food groups [8]. Food items and food groups used in similar nutritional education tools were different depending on the targeted population, food availability, cultural preferences and food consumption patterns.

When the newly developed booklet was introduced to DM patients in the second phase, more than half of the study participants (61.1%) were above the age of 45, to be exact, 12 participants in 46-55 years age group and 10 in 56-65 years age group. Overall, the participants had the mean age of 48.44 ± 10.72 years. These findings agreed with the projection by King et al [9] which said that the majority of people with diabetes mellitus are in the age of 45-64 years in developing countries and this trend was projected to be accentuated by the year 2025.

In this study, most of the participants (38.9%) were found out to have hypertension at the same time with diabetes. Since DM and hypertension share common risk factors, these two diseases are becoming twin challenges in developing countries [10]. According to the report on national survey on diabetes and risk factors for non-communicable diseases in Myanmar (2014), prevalence of raised blood pressure was 26.4% and that of raised blood glucose was 10.5% [2].

Of all the study participants, 63.9% were obese according to body mass index cut-off by WHO criteria for Asian population. Among these obese participants, 57.9% were female and 70.6% were male.

However, the report on national survey of DM and risk factors for non-communicable diseases in Myanmar (2014) stated that overweight and obesity prevalence was more in females than in their counterparts [2].

This study pointed out that the participants with different background characteristics can understand the contents in the booklet and so the post-test scores increased remarkably. Moreover, they were satisfied with the developed booklet and they would like to recommend this booklet to other DM patients and were willing to use this booklet in their daily living.

CONCLUSION
The newly developed education booklet was found out to be effective by improving the participants' knowledge about diabetes and basic carbohydrate counting as well as satisfactorily accepted by adult diabetes mellitus patients in Myanmar.

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