## Research article

# An Exploration into Understanding Perceptions about Food Estimation and Portion Control in Type 2 Diabetic Thai Adults: A Qualitative Study

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**ABSTRACT**

Control of portion size is a crucial goal in medical nutrition therapy for people with type 2 diabetes. This study aimed to explore the understanding about food estimation and portion control in Thai adults with type 2 diabetes. Semi-structured interviews were conducted with 24 Thai adults type 2 diabetes. A deductive thematic analysis of the transcriptions of audio recording was used to create codes, an index, and themes. Four major themes were identified: (i) Misunderstandings surrounding the most appropriate diet for diabetics and sources of carbohydrate; (ii) Problems with the methods of food estimation; (iii) External factors contributing to overconsumption; (iv) Attitudes leading to malpractice. Participants *misunderstood some dietary concepts,* especially those surrounding carbohydrates. They perceived that rice as being a bad carbohydrate source, while fruit is a good one. Participants' misconceptions surrounding portion controlled to inaccurate food estimation and lower varieties of food types. Diabetes educators need to clarify the concept of a healthy diet with people with type 2 diabetes as well as concepts of diabetes management and a treatment goal. The usual estimation techniques need to be adjusted to suit local Thai eating styles. The addressing of external factors affecting behavior should be of greater concern during dietary education; the factors including constraints around jobs and the social impact of family and friends.

**Keywords:** Portion control, Food estimation, Type 2 diabetes, Healthy food, Diabetes education, Qualitative study

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## Introduction

Diabetes mellitus is one of the fastest growing health problems in the world. Globally, 382 million people were estimated to diabetes in 2013 (8.3%) and this is projected to rise to 592 million in 2035[1]. Thailand is one of the top 10 countries in the Western Pacific region as regards to number of people affected by diabetes[2]. Although the number of undiagnosed cases was reported as being reduced from 66.5% to 47.3% in men and from 51.4% to 23.4% in women between 2004 and 2009, the proportion of patients with poor glycemic control was still high. More than 70% of diabetic patients in tertiary care hospitals had HbA1c >7% (53.0 mmol/mol) and the prevalence of diabetic complications was notable (31.2% retinopathy, 43.8% nephropathy)[3]. The cost of diabetes will increase depending on the severity of the associated complications which will include those associated with disability.

Dietary intervention is an important management issue in the prevention of complications[4]. Eating habits and nutrition status should be assessed to provide appropriate medical support to patients, for example meal plans need to be individualized. It has been reported that nutrition therapy by a registered dietitian resulted in a moderate reduction in HbA1cin people with type 2 diabetes. The goal of dietary intervention is the creation of a healthful eating pattern with appropriate portion sizes[5]. Food portion size influences both the energy intake and meal composition. Diabetes educators often teach patients to use reference sizes (hand, household measurements)[6]. It is a common method for weight control, but it has also been reported as being a major barrier for dietary adherence[7]. Most patients believe that it is hard to follow a healthy eating plan in real life[8].

There have been few studies in Thailand which focus on the perceptions of people with diabetes. Any research interest in this field involved contextual factors such as a belief in Buddhism[9,10], the position of medical doctors in Thai society[11] and the interpretation of doctor's dietary suggestions[12]. There is little information about dietary management, focusing on the perception of people with type 2 diabetes food. Therefore, this study aims to explore understanding regarding portion control in Thai adults with type 2 diabetes.

## Methods

### Participants and Recruitment

The sample group is people with type 2 diabetes who attended the Diabetic Clinic at King Chulalongkorn Memorial Hospital between August and December 2016. Initially, evaluation of knowledge about diabetes[13] was conducted at the Diabetic Clinic, and medical records were reviewed. Inclusion criteria were being adults, of 20 years old and over, were diagnosed with type 2 diabetes for at least 1 year, able to read and communicate in Thai. Volunteers who were pregnant, diagnosed with hemolytic anemia, cancer or chronic kidney disease, had cognitive impairment and were on steroid therapy were excluded. People who met the eligibility criteria were approached by medical staff. If they were interested in the study, participants were

introduced to the researcher and the research details were explained. The patients were allowed to make decisions independently after being given all the information about the protocol. If the patients volunteered to participate in the study, the researcher provided a consent form to read and sign. Afterwards, participants were invited to attend an interview at the date. The interviews took place at King Chulalongkorn Memorial Hospital. All participants were given standard diabetes education based on Thai Clinical Practice Guidelines for Diabetes 2014[14]. These guidelines suggest carbohydrate counting and food exchange education as means of assisting glycemic control. Vegetables, wholegrain cereals, beans, fruit and low fat milk are recommended. The caloric distribution is 50% carbohydrate, 30-35% fat and 15-20% protein. The diet should contain at least 130 grams of carbohydrate. In addition, low glycemic index and high fiber foods are promoted to help regulate blood glucose level. Twenty-four subjects with a variety of diabetes knowledge levels participated in the study.

**Procedure**

Data were collected by semi-structured interview. Interviews were scheduled for approximately 60 minutes for each participant. The interview guide (Table 1) was developed based on areas of interest and used to direct the overall interview. Participants were encouraged to respond to open questions. All interviews were conducted by the same researcher and were audio recorded for verbatim transcription. Socio-demographic and biochemical data collection forms consisted of age, education level, occupation, medication and HbA1c levels retrieved from medical records.

**Data Analysis**

The framework method was used to permit a deductive thematic analysis[15].All interviews were audio recorded with consent from participants. Firstly, the interviews were transcribed verbatim and the audio recordings were double-checked to ensure accuracy. Secondly, notes were made during the reading of the transcript and listening to the audio-recorded interview to ensure familiarization with the interview. Thirdly, the data was classified and labeled with a code. The code was developed from areas of interest. Fourthly, the data was organized into a framework matrix. Fifthly, the data set was reviewed and connections identified to create themes. The quotes were selected to represent and support the findings. Each code, index, theme and the framework were discussed among the researchers. Data gathering and analysis continued in sets of three participants until a new theme did not emerge. The processes of coding, charting and mapping was collated in Microsoft Office Excel 365 Education E1[16].

**Ethical Considerations Methods**

All procedures in this study had been approved by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand (IRB No.265/59, COA No.602/2016).

**Table 1** Interview guide

| | |
|---|---|
| **General introduction** | - When were you diagnosed with type 2 diabetes? How did you find out that you have diabetes?<br>- Do you have any other diseases?<br>- How about the treatment? What medication do you receive?<br>- Do you have a glucose meter? If yes, how often do you use it?<br>- What do you think about diabetes?<br>- Are you satisfied with your current glycemic control? |
| **Knowledge about diabetes** | - Have you received diabetes knowledge before? On which topic?<br>- How do you get the knowledge? From whom or where?<br>- Which information do you think helps you to control your blood glucose level?<br>- In your opinion, how well can you apply the knowledge given about diabetes by medical staff in real life? Why? |
| **Concepts about healthy diet** | - Could you describe the characteristics of a good diet for people with diabetes?<br>- How do you select healthy food?<br>- Could you give me an example of a healthy food choice?<br>- Then please give an example of an unhealthy food?<br>- What kind of food impacts on your glucose level? |
| **Food estimation** | - Do you create your diet plan? If yes, how?<br>- Please describe the amount of food that you think you should eat in a meal<br>- Do you use carbohydrate counting or food exchange for portion control? Why? And how do you estimate the carbohydrate?<br>- If it is food that you have never seen before, how do you estimate an appropriate portion?<br>- Do you know about nutrition labelling? What do you think about it? How does it contribute to your management of diabetes?<br>- How often do you read nutrition labels?<br>- Which part of the nutrition label that do you think is important to read?<br>- Does it have an impact on your decision to buy it? |
| **Barriers to portion control** | - What are significant barriers to you in maintaining your control of portion size?<br>- Please explain about the situation and how do you cope with it?<br>- Does it have impact on your blood glucose level? Why?<br>- Do you discuss these problems with medical staff? Why? |

## Results

### Participants' Characteristics

The study group included 24 participants, 7 men and 17 women. The mean age was 59.04±10.13 years. Eight participants had an education level up to high school and the remaining had higher level. Thirteen participants were retired while eleven were still working. Half of them received only oral medication but the rest were on insulin therapy with or without oral medication. Ten participants maintained good control of their diabetes (HbA1c≤7% or 53.0 mmol/mol).There were 9 participants who were classified as having a high diabetes knowledge level, 7 participants with moderate knowledge and 8 participants with a low level. (Table 2)

**Table 2** Sociodemographic characteristics of participants (n=24)

| | Characteristic | n | % |
|---|---|---|---|
| Gender | Male | 7 | 29.2 |
| | Female | 17 | 70.8 |
| Age (years) (Mean ± SD) | | 59 ± 10.1 | |
| Education level | Elementary school | 6 | 25.0 |
| | High school | 2 | 8.3 |
| | Diploma | 8 | 33.3 |
| | Bachelor Degree | 5 | 20.8 |
| | Higher than Bachelor Degree | 3 | 12.5 |
| Occupation | Government officer | 2 | 8.3 |
| | Business owner | 4 | 16.7 |
| | Employee | 5 | 20.8 |
| | Retiree | 13 | 54.2 |
| Treatment | Oral medication only | 12 | 50.0 |
| | Insulin with oral medication | 10 | 41.7 |
| | Insulin only | 2 | 8.3 |
| HbA1c | Well controlled (HbA1c ≤ 7% or 53.0 mmol/mol) | 10 | 41.7 |
| | Poorly controlled (HbA1c > 7% or 53.0 mmol/mol) | 14 | 58.3 |
| Diabetes knowledge level | High | 9 | 37.5 |
| | Moderate | 7 | 29.2 |
| | Low | 8 | 33.3 |

All participants were enthusiastic and effusive in delivering information in the interviews. They talked freely about their experiences of diabetes and eating practices. Four major themes were identified as follows: (i) Misconceptions of diet for the management of diabetes and sources of carbohydrate (ii) Problems with the methods of food estimation (iii) External factors contributing to overconsumption (iv) Attitudes leading to malpractice (Table 3).

**Table 3** Themes and findings from people with type 2 diabetes

| Findings | Area of interest |
|---|---|
| **Misunderstandings surrounding the most appropriate diet for diabetics and sources of carbohydrate**<br>- Diets for diabetics should be tasteless, unappetizing and contain a low amount of rice.<br>- Rice is a bad carbohydrate source, while fruit is a good one.<br>- Vegetable oil and animal skin contain carbohydrate<br>- Milk, beans and guava do not contain carbohydrate<br>- Food that the doctor gives advice to eat is free from carbohydrate<br>- Non-white food is healthier than white food<br>- Food products with any nutrition claim helps to relieve diabetes | **Understanding Barrier** |
| **Problems with the methods of food estimation**<br>- Lack of numeracy and cooking skill<br>- Nutrition label too difficult to read due to small font size<br>- Misinterpretation of nutrition label due to no concern about portion / serving size<br>- When HbA1c level is unfavorable, this will be associated with food taken just before that medical visit.<br>- High carbohydrate foods are sweet, sticky and soft<br>- Level of ripeness of fruits is related to the carbohydrate content | **Understanding Practice Barrier** |
| **External factors contributing to overconsumption**<br>- Family members or friends give favorite and unhealthy food.<br>- Family members or friends urge people to eat out.<br>- Work intensity which requires high energy<br>- Overtime working hours increase the number of meals | **Practice Barrier** |
| **Attitudes leading to malpractice**<br>- Poor glycemic control is the consequence of a poor genetic trait<br>- Satisfaction with current glycemic control even when the results are poor<br>- Presumption that they know all about diabetes<br>- The information on nutrition labels is not credible.<br>- Feeling guilty about leftover food | **Understanding Barrier** |

**Misunderstandings surrounding the most appropriate diet for diabetics and sources of carbohydrate**

The theme analysis on the misunderstandings surrounding the most appropriate diet for diabetics and sources of carbohydrate was shown in Fig 1.

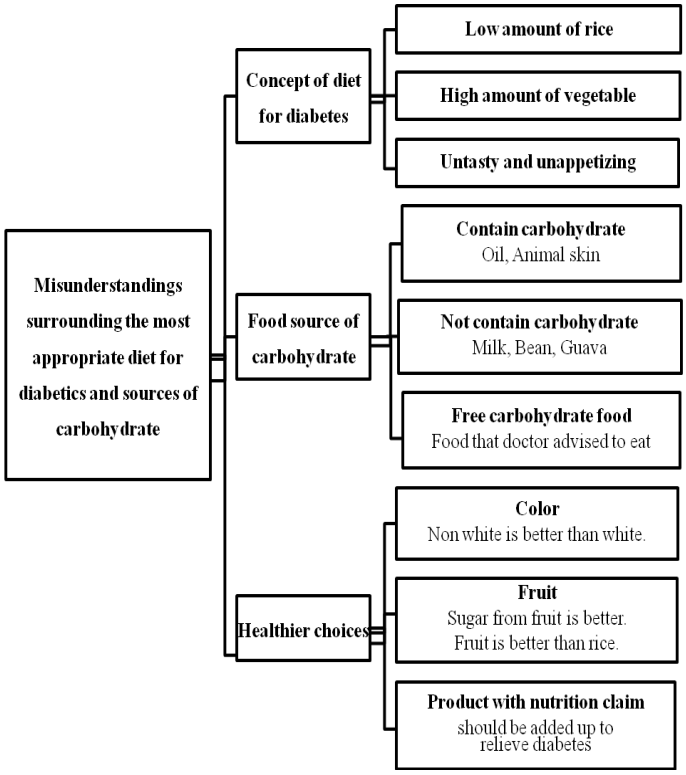


**Fig.1** Thematic analysis I: Misunderstandings surrounding the most appropriate diet for diabetics and sources of carbohydrate

All participants understood that diabetes cannot be cured, but it can be controlled. Most of them knew that there was a need to manage their diet to control diabetes and that this would be a challenge for their whole life.

*"…When I was diagnosed with diabetes, I thought it would be cured if I could just stop drinking soda. After attending diabetes education class, I learned that diabetes could not be cured. I need to take care of myself. Diet control is definitely very important in diabetes management. I changed my habit of taking white rice to brown rice. I tried to eat desserts less frequently after meals changing it to fruit. I need to change most food I usually eat. This is not just transient. It is a change for the whole of my life …" (P01, Female).*

Most participants described the characteristics of a good diet for people with type 2 diabetes as "a low amount of rice and a high amount of vegetables". In their opinion, rice was a major cause of raising blood glucose level. Sugary foods were not mentioned until they were engaged with the researcher's questions. They explained that avoiding sugary food is a basic concept of diabetes that everyone should know. Healthy food for the management of diabetes was thought of in a

negative way. They complained about the taste and appearance of such food. It was described as having an unfamiliar taste and appearance. The participants felt that it is good for health, but it takes away the pleasure of eating:

*"…Eat small amount of rice, tasteless food and plenty of vegetables. This is the diet that people with diabetes should eat, but we do not like it. We like tasty foods…" (P22, Female).*

Most participants mentioned the extreme amount of rice. They said their doctors allowed only one or a half ladle of rice (1 ladle = approximately 1/3 cup), and that the doctor seven recommended stopping eating rice if they can. They understood that rice, noodles, taro, and potato had a similar amount of carbohydrate. They also thought that all of them could raise their blood glucose level, but fruits would not. They thought "Even if fruits contain some sugars, they are different from table sugar". Non-white sugars are described as a special type of sugar:

*"…Do not select white sugar because it is not suitable for people with diabetes. Do not trust sugar from sugarcane. I select sugar from coconut that is not white (it is light brown)…" (P14, Female).*

Most participants defined carbohydrate as rice and starch, but some had misunderstandings about animal skin and vegetable oil containing carbohydrates. They pointed out that if a doctor stated that a certain food should be limited, such food would be high in carbohydrate. In addition, a common misunderstanding was that milk and soybean contain only protein because they are in the protein group, one of the five food groups. All participants knew that non-white rice was better than white rice, but about half of them misunderstood that brown rice did not contain carbohydrate. Similarly some participants thought that guava contained mainly fiber and no carbohydrate. Moreover, any food that was advised by a doctor as being good to eat is misinterpreted as being free of carbohydrate. When they received information about good food choices for management of diabetes, they misinterpreted that consuming such food could lower blood glucose level. Besides, participants were likely to select a food product having a nutrition claim with a view that it was good for diabetes management, even if such a claim was not related to diabetes:

*"…I am concerned to buy healthy foods. For milk, I choose low fat and high calcium. I could drink it without increasing the blood sugar level…" (P07, Male).*

**Problems with the methods of food estimation**

The thematic analysis on the problems with the methods of food estimation was shown in Fig 2.

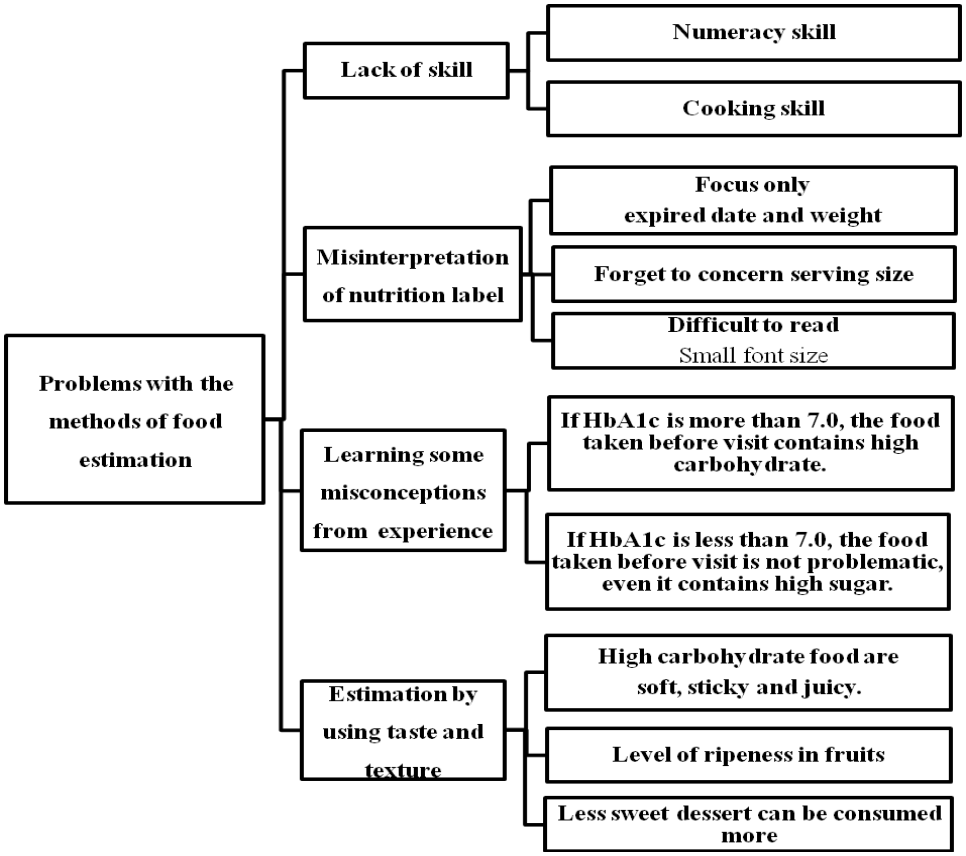


**Fig.2** Thematic analysis II: Problems with the methods of food estimation

Both the type and the amount of carbohydrate affect glycemic control. Participants with a high education level used carbohydrate counting to manage their blood glucose level, but it might not be suitable for people with low numeracy skills. Some participants explained that since they were not familiar with cooking, it would be difficult to identify the ingredients containing carbohydrate in the food. In addition, some participants felt uncomfortable when they had to calculate food portions during meal time:

*"…I received education about food portion estimation, but I do not really pay attention. I think it is too complicated. It is impossible to do it in mealtime..." (P16, Male).*

Although information from nutrition labels was useful for carbohydrate counting and food estimation, more than half of the participants did not read it properly. They focused on the expiry date and food weight to select the best one. If it had nutrition claim on the front label of the product, the participants would ignore reading the nutrition facts on the rear panel. Eight participants read the nutrition label, but only 2 participants were concerned about serving size. The most common problem regarding reading nutrition facts from the label was the too small font size. The elderly participants need assistance in reading nutrition labels.

Participants reported that it was difficult to remember the portion size of the numerous food items taught in diabetic class. Thus they used life experience to classify foods. Portion size from hospital food during admission was a model used by some participants to relate to portion size. Some related good foods and bad

foods by blood test results from each medical visit or from their own blood glucose meter. If the result was not good, the food they ate before the visit is to blame. On the other hand, if the test is still within the target range, the food would be considered good, even when it contained high amounts of sugar. Participants thought that a specific food might be bad for diabetes patients in general, but it was not problematic for them. Sweetness and texture were also criteria for food choice. The participants understood that if food tasted very sweet, it should be eaten in low amounts and vice versa. Soft, sticky, and juicy foods were categorized as high carbohydrate foods while tough, dry, and crispy foods were considered low carbohydrate foods. The level of ripeness in fruits influenced how the participants decided the amount they could consume:

*"…As fruits should not be too sweet and ripe. Good fruits should be raw and have sour taste and hard to chew which was healthy. For example, soft and ripe guava is not good. You have to buy the one with tough texture and raw…" (P22, Female).*

**External factors contributing to overconsumption**

The theme analysis on the external factors contributing to overconsumption was shown in Fig 3.

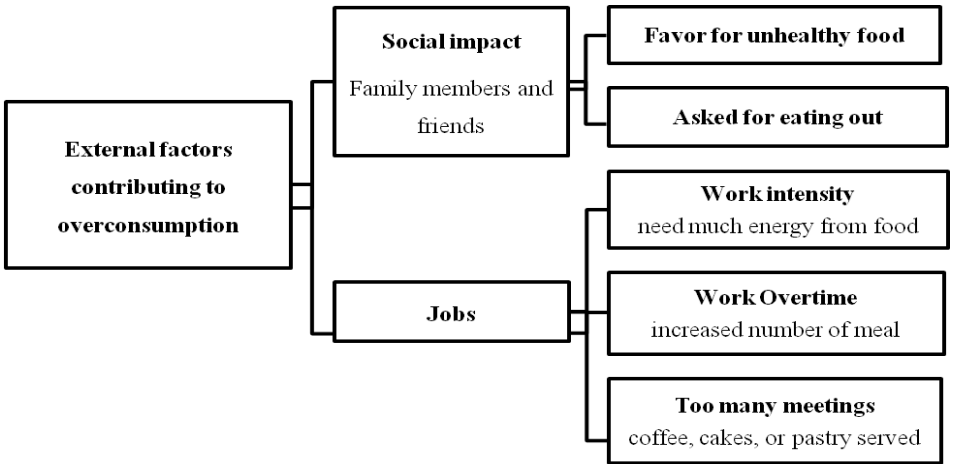


**Fig.3** Thematic analysis III: External factors contributing to overconsumption

All participants in this study agreed that family members and friends had influence over their food selection. They deemed it very difficult to stay healthy when eating out with their friends or family because a buffet restaurant is commonly selected. In addition, their sons or daughters or friends often bring favorite desserts or snacks for them, which are great temptations and difficult to resist. Some participants who tried to take lesser amounts of desserts or snacks offered by their family or friends but they could not because taking smaller amounts of the food can cause offence. A classic example was:

*"…Buy, buy, buy again and again. I knew she loves me, but she does not care about my blood glucose level. If I do not eat snacks she bought, she will be angry. She said that*

*small amount of snack cannot harm you and you should manage your blood sugar level tomorrow…" (P08, Female).*

However, there were examples of where family members and friends, with a genuine understanding of diabetes, helped the participants to better manage their blood glucose level:

Some participants who still work complained about the amount of rice that their doctors suggested. They explained that if they ate only 1 ladle of rice at each meal, they did not have enough energy for working. In addition, one participant had to work overtime and she needed to increase the number of meals she ate. Three participants pointed out that the frequency of taking desserts increased according to the length of the meeting in their work life. This included a cup of coffee and a piece of cake or a pastry. One participant, a taxi-driver, had a problem with eating at a fixed time resulting in having frequent hypoglycemic episodes:

*"…My doctor said that you should have meal at a fixed time. I try to do it, but sometimes I have passengers at mealtime. If I feel dizzy, I will take my candy. I try to follow the doctor's suggestion. I know I should take care of myself…" (P16, Male).*

**Attitudes leading to malpractice**

The theme analysis on the attitudes leading to malpractice was shown in Fig 4.

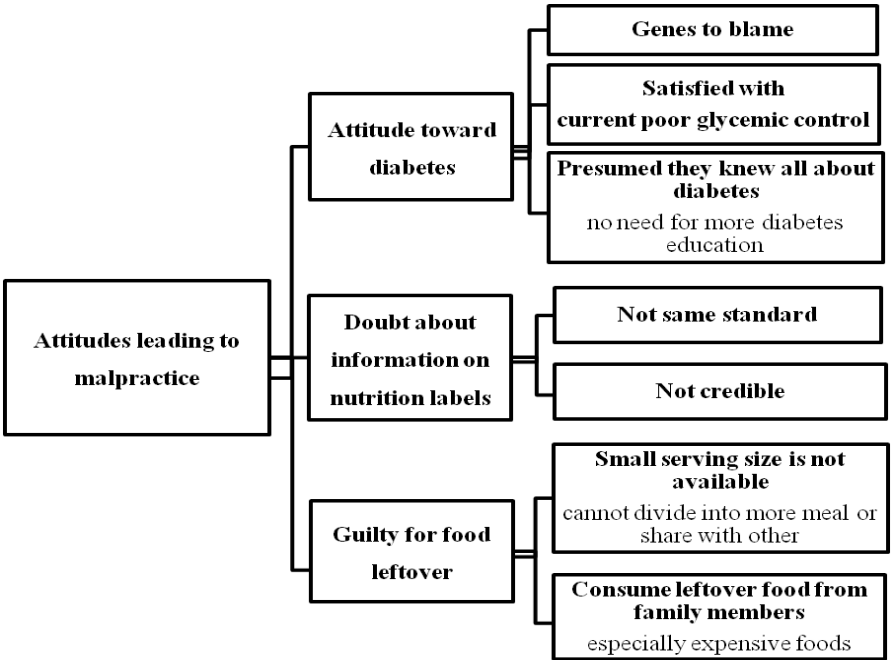


**Fig. 4** Thematic analysis IV: Attitudes leading to malpractice

Nutrition knowledge is one of the key components to assist in controlling blood glucose level. Nevertheless, some of the participants, who had received diabetes education, had poor glycemic control despite adequate pharmacologic management. Some participants projected the failure in blood glucose control to their genetic trait and insisted that they had selected good food choices and consumed a proper portion size. Only 2out of

the 14 participants with poor glycemic control were unsatisfied with their current glycemic status. The rest of this group relied on self monitoring blood glucose (SMBG) before breakfast more than HbA1c level. Each participant had their own glycemic control criteria. The range of their SMBG criteria was 5.5 to 11 mmol/L for their fasting reading. Most participants with poor glycemic control pointed out that an HbA1c of less than 7% (53.0 mmol/mol) is too strict for the elderly. They had nocturnal hypoglycemia if their HbA1c was controlled under 7% (53.0 mmol/mol). One participant said that he did not pay attention how high his blood glucose level if he can work normally. Moreover, most participants with high levels of education assumed they knew all about diabetes including proper diet. In fact, in this group there were some misconceptions which if not addressed might cause uncontrolled glycemia:

*"…I am so bored when I have to go to the diabetes education room. It wasted my time because I heard about this lesson more than 10 times. It is extremely boring. If I stay silent, it will end faster…" (P16, Male)*

Half of the participants stated that they did not believe the information on the nutrition labels because in their view it did not seem logical. For example, a food product labeled sugar-free can still taste very sweet which is not acceptable. Also nutrition information on the label of a food product will selectively show only the good point. So it is not worth taking time to read:

*"…It is an advertisement. Some of them presented low sugar, but it tastes very sweet. Some of them still tastes sweet, even it is labeled 0% sugar…" (P21, Female).*

One more factor that participants mentioned was controlling the serving size. They feel ashamed if they left food on their plate. In their opinion, wasting food caused one to feel guilty. It is almost impossible for them to buy a small serving size. The available size is larger than they need. Some participants tried to solve this problem by dividing food into 2 or 3 meals, but this solution needs a refrigerator. Others reported an alternative way was giving leftover food to a pet. However, if their family members cannot finish the food, they will help finish it, especially if the food is expensive:

*"…I bought sticky rice with ripe mango for my father. It is very expensive, but my father eat only two or three spoons leaving about half of kilogram of the sticky rice. Then, I took it all…" (P20, Female).*

## Discussion

This study explored the understanding of portion control in people with type 2 diabetes, covering a span of participants' beliefs and reported behaviors. Participants described characteristics of diet the findings of which were consistent with other studies in Thailand[11, 12]. The common Thai diet consists of rice with at least 2 side dishes. Rice is the major staple food for Thai people in everyday life[17]. A previous study reported that rice is considered as meaningful for Thai people. The advice to consume less or avoid rice seems to be problematic. It makes Thai people feel like they are changing their whole life[11]. Diabetic patients used different strategies to reduce rice

consumption. Brown rice was selected to replace white rice, without reducing the amount consumed. Some filled up their stomach with soymilk to reduce hunger levels and appetite because they misunderstood and thought that it does not affect their blood glucose level[12]. The American Diabetes Association's (ADA) do not indicate the recommended amount of carbohydrate intake for people with diabetes. But they provide suggestions about good sources of carbohydrate that help to promote high fiber and give a low glycemic load[5] . Carbohydrate restriction is usually selected as the first step in dietary management to lower postprandial blood glucose level which is often monitored using the HbA1clevel. It is easier to reach a glycemic goal than to lose weight[18]. The major nutrient which renders an excessive energy intake is carbohydrate and the percentage of energy from carbohydrate has been shown to increase as obese people increase their total energy intake[19]. Rice, the main carbohydrate source in Thailand, has the greatest impact on diet therapy in Thai people. It is such a challenge to find ways to cut down the amount of rice in the diet while keeping the amount of carbohydrate in other foods constant or at least not increasing it.

Portion size estimation is an important skill for people with type 2 diabetes. Inaccurate estimation of carbohydrate content in food was found to be related to uncontrolled blood glucose level[20]. However, too much restriction in carbohydrate could increase the hypoglycemic risk. Although mild hypoglycemia is a common event of which diabetics need to be aware, an over-concern of this may cause a problem. Fear of hypoglycemia is significantly associated with blood glucose fluctuations[21]. Understanding the effect of carbohydrate on blood glucose level, accurate food portion estimation, and a resultant controlled meal design helps prevent hypoglycemia[20].Food exchange is a common method of food estimation in Thailand. Food models are important tools for serving size education[22]. Although serving sizes of the Thai food exchange list used household measurement, the participants still complained that it is difficult to understand especially those who are not familiar with cooking. The finger width method may help solve this problem, but accuracy depends on the shape of food. The method is suitable for food with a geometric shape and should be considered if used with foods of an amorphous shape[23]. However, the characteristics of Thai foods are different from western foods. Thai dishes commonly contain several ingredients. It is more difficult to estimate the macronutrient content because the same type of food is not separated on the plate. A previous finding revealed that mixed dishes may lead to overestimation of carbohydrate[24]. In addition, fruit exchange criteria are extremely difficult to remember. Although the carbohydrate counting method is good for a flexible meal plan, it seems to be complicated for people whose education is lower than high school level. They frequently have a problem with numeracy skills. A previous study found that the accuracy of carbohydrate counting was not related to HbA1c[25]. It is possible that carbohydrate counting is not an appropriate method for people in general. A glucose meter is an important tool, particularly when participants try new foods or food in which they do not know the amount of carbohydrate. It helps people

with type 2 diabetes evaluate what is an appropriate amount of food. Paired-meal SMBG testing helps to enhance personal knowledge about carbohydrate in the diet. It represents carbohydrate content in the meal and its level of impact. People with diabetes have been shown to have more motivation to adjust their diet[26]. This can be called self-regulation[27]. If participants do not have a glucose meter, they evaluate their diet from the characteristics of their food as per the taste and texture.

In Asian culture, food in itself and eating have life meanings. It represents social bonding, good health and human interaction. Friends and family members are frequently involved in eating activities. Loved older people receive their favorite foods or traditional food as gifts[12, 28]. It is then very hard to refuse to eat it because it reflects love and care. Similarly, eating out is related to excess energy intake[29], but refusing an invitation to eat out could mean refusing the relationship. It is difficult to meet friends without eating out.

In this study, although participants had a chance to meet a diabetes educator, their response was that they felt it was useless and boring. However in a previous study 'respected care providers mindfully listened and showed their care toward the client' was reported. They involved patients in the decision making process in non-hurried consultations. Patients had confidence in their healthcare staff if they received clear answers to improve their understanding[30]. According to public health statistics from 2016, the ratio of the population to healthcare staff in Bangkok was 716 per physician and 205 per professional nurse. For the whole country, the physician to population ratio was 1:2035 and the ratio of a professional nurse to the population was 1:436[31]. It is possible that insufficient healthcare professional is related to the length of counseling time. Some miscommunication may occur in short conversations.

Despite favorable results in this study, it is important to keep in mind that the sample size was small which gives a limited ability to generalize the results. However, participants were recruited until data saturation. For the future, therefore, it is recommended to find some other differences and carry out a larger sample size investigation. All participants in our study lived in the capital city, Bangkok. People who live in rural areas may have different experiences in glycemic control. Also this study is of a cross-sectional design so it could not show changes of understanding or eating habits which would become evident in a longitudinal study.

A third limitation is that many well-accepted sets of dietary guidelines and strategies for people with type 2 diabetes have been developed in a western setting with culture differences and may not be applicable in a Thai context. In Thailand, information about the food perceptions of people with type 2 diabetes is scarce. In the opinion of some participants some diabetes educators do not understand their problems related to being a type 2 diabetic, including how to integrate healthy foods to everyday life in the real world.

Findings from this study may assist in the application of diabetes education. It could help guide healthcare professionals in seeking out and helping solve patients' misconceptions and reduce barriers. Information from

participants' experiences could provide a more comprehensive picture to inform the design behind appropriate dietary intervention, especially in methods for food estimation. It would be useful to expand the exploration in different regions of Thailand, recognizing that there are different cultures and lifestyles in each area. Moreover, future studies in newly diagnosed people may reveal interesting perceptions since the number of years after diagnosis could affect eating habits and knowledge.

## Acknowledgments

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## Conflict of Interest

The authors declare no potential conflict of interests.

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