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CMU Healthy Break,The Web-Base Program for the Nutritional Value Calculating of Thai Snack to Support Healthy Consumption

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Abstract-The objective of this research is development of CMU Healthy Break, a web-base computer program to analyze the nutritional value of snacks. In particular, it underlines the expression of nutrients, including total energy, sugar, fat and salt content. CMU Healthy Break is developed by using PHP language based on web application responsiveness. This system has been connected to MySQL database and all data is backed up on cloud storage. In evaluating the effectiveness of CMU Healthy Break, it was found that the overall effectiveness score was4.65 ± 0.38. This means that the developed system has a very good level of effectiveness. The results of the evaluation of the difficulty of CMU Healthy Break by the user were found that the overall difficulty of the program had an average score of 1.61 ± 0.48, indicating that the CMU Healthy Break was easy to use. The overall satisfaction was the average of 4.74 ± 0.57. The CMU Healthy Break offers practical nutrients evaluation of snacks that are useful in the day-to-day selection of snacks for consumption and various activities.

Keywords: Web-Base Program, the Nutritional Value Calculating, Snack

I. INTRODUCTION

Nowadays, countries around the world suffer from the illness of the population with Non-Communicable Diseases (NCDs) with a long period of disease progression. The main risks come from improper everyday behavior and as a result, the death rate is increased(Wang & Wang, 2020).It made the patient's quality of life and daily life more difficult. It is also the burden of the government to subsidize a higher budget for patient care(Kankeu, Saksena, Xu, & Evans, 2013; Wang & Wang, 2020).In Thailand, the incident rate of illnesses from NCDs is consistently high and increasing. It was found that the mortality ratio ofcardiovascular and stroke was 29 and 25 per 100,000 population, respectively(Angkurawaranon, Wattanatchariya, Doyle, & Nitsch, 2013; Narisa, Uraiporn, & Alongkote, 2018).The cause of illness with chronic NCDs is known to be caused by improper lifestyleswhich includeinactivities and improper eating habits(Rippe & Angelopoulos, 2016).Especially the changing dietary behavior of Thai people, which affects the quality of food eaten.Due to the expansion of urban communities nowadays, the way of life of the Thai people is more urgentthat they prefer to eat fast food which consists of a higher amount of fat and sugar(Chavasit, Kriengsinyos, Photi, & Tontisirin, 2017).Previous research has confirmed that eating high amounts of such a nutrient source affects weight gain and the risk of developing NCDs(Asghari, Yuzbashian, Mirmiran, Mahmoodi, & Azizi, 2015; Kamkuemah, Gausi, & Oni, 2021), and food sources high in sodium increase the risk of hypertension and chronic kidney disease(Rusmevichientong et al., 2021).It is found that Thais are more likely to buy convenient food in department stores where both Thai and foreign food contain high amounts of fat and sugar causing a gradual tendency of people to be overweight(Narisa et al., 2018).Therefore, one of the prevention measures for chronic non-communicable diseases is to encourage the population to pay attention to their diet by avoiding eating foods high in sugar, fat, and salt(Chavasit et al., 2017; Ley, Hamdy, Mohan, & Hu, 2014).

Choosing the right food in terms of quantity and quality is particularly important. That will allow consumers to get the right amount of nutrients, not too much or too littlethat can reduce the risk of getting any unwanted disease or illness. However, choosing nutritionally appropriate foods is difficult and unfamiliar

to the general public. Because each food has different amounts of nutrients and energy which depends on various factors such as types of food, food sourcesor raw materials used in food production, etc. From a review of previous researches, it was found that several computer programs or applications on mobile phones have been developed to help calculate the nutritional value as well as the optimal amount of food intake, such as the INMUCAL-Nutrient program whichdeveloped by Mahidol University(Mahidol University, 2021)and Thai Nutri Survey program which developed by the Department of Health, Ministry of Public Health of Thailand(Department of Health Ministry of Public Health of Thailand, 2021),etc.Each program has a different nature and purpose of use. Most of the programs available today focus on analyzing the main meals.However, no computer program or mobile application has been developed for the analysis of the nutritional value of snacks. According to the previous reports, Thai people have consumed snacks or light mealthat is not a staple food in a large quantity and are increasing(Chantana Aungchoosak, 2012; Wungrath, Onduang, Chanwikrai, Singhan, & Baitragul, 2018).Most snacks contain improper nutritional value. Some contain excessive amounts of nutrients, such as starch, sugar, fat, sodium, etc. if consumed improperly, it can be harmful to health and lead to disease and illness(Chantana Aungchoosak, 2012).Moreover, the policy of the Ministry of Public Health of Thailand campaigning for Thais to reduce the consumption of sugar, fat, and salt to prevent the occurrence of chronic non-communicable diseases with the goal that by 2022,Thais will be able to reduce the consumption of sugar, fat, and salt by 30 percent.

The researchersas public health personnel are intended to develop a web-based program for calculating the nutritional value of snacks, CMU Healthy Break. It has compiled a list of more than 500 snacks item that is popular to eat in Thailand, highlighting the value of essential nutrients for the control and prevention of chronic non-communicable diseases according to the policy of reducing consumption of sugar, fat,and saltas a tool to assist general consumers to be able to calculate the nutritional content from snacks and to choose appropriate snacks. It can be practical in daily life and can be used to help organize snacks on different occasions such as meetings or banquets. It can lead to the consumption of healthy snacks and reduce the occurrence of disease and illness to sustainable good health of the people.

II. METHODS

1. Population and sample

The sample group in this study was divided into 3 subgroups as follow:

1.1 The needs analysis and program development guidelines:consisted of 5 nutritionists, 5 entrepreneurs and snack producers, 20 general consumers agedbetween 18-70 years old.

1.2 User group:including general consumers living in Chiang Mai, with convenient samplingand agreement to provide information through online questionnaires. Because the number of population is not known,therefore, the researcher followed the sample size calculating with the Cochran formula(Cochran & William, 1977), 95% confidential and allowing the error not exceeding 0.05, as the following formula:

$$n = \frac{\mathrm{P}(1-\mathrm{P})(\mathrm{z})^2}{e^2}$$

Calculated the sample size of 384 to prevent loss and not obtaining the required number of samples the researcher then increased the sample size by 10%, resulting in a total sample size of 422.

1.3Software analysis expert: consisted of 2 computer scientists.

2. Research instruments

2.1 Development of CMU Healthy Break program

CMU Healthy Break is developed by using PHP language based on responsive web applications. This system has been connected to MySQL database and all data is backed up on cloud storage.

The program development is divided into 5 phases according to the software production process model, namely the project planning phase,analysis phase,design phase, implementation phase, and maintenance phase(Dennis, Wixom, & Roth, 2008; Dennis, Wixom, & Tegarden, 2009).

2.2 The questionnaire, interview form and assessment form consist of:

2.2.1 Unstructured interview form: the purpose was to interview the needs and guidelines for the CMU Healthy Break.

2.2.2 General information of the sample questionnaire.

2.2.3 The effectiveness evaluation form for the CMU Healthy Breakassessed by experts in computer science and information systems.

2.2.4 Difficulty evaluation of the CMU Healthy Break form with a rating scale of 1 to 5The interpretation of mean scores waseasy (1.00 - 2.33scores),moderate (2.34-3.67scores) and difficult (3.68 - 5.00scores).

2.2.5 Satisfaction evaluation of the CMU Healthy Break form with a rating scale of 1 to 5The interpretation of mean scores wassatisfied (1.00 - 2.33scores), moderate (2.34-3.67 scores) and not satisfied (3.68 - 5.00scores).

3. Data collection

3.1Conduct interviews with groups of informants, needs and guidelines for the development of theCMU Healthy Break. In the target audience as specified.

3.2Carry out snack food collection by compiling from various sources including1.Thai Food Table, Nutrition Division, Department of Health, Ministry of Public Healthof Thailand(Nutrition Division & Department of Health, 2001)2.Thai food composition database, Institute of Nutrition, Mahidol University(Institute of Nutrition, 2015)3.Thai food database, Research Institute of Health Sciences, Chiang Mai University(Research Institute of Health Sciences, 2020)4.Other academic resources such as academic articles, research articles, and dissertations.The researcher selects the most popular snacks to be consumed in Thailand. The snacks are divided into 3 groups, consisting of 1.Snacksor light meal 2.Fruits 3.Beverages, determine the nutritional value and desired nutrients to be displayed, including total energy, fat content, sugar content, and sodium content.

3.3Continue to develop theCMU Healthy Break by experts in computer science and information technology using information from 3.1 and 3.2 as a basis for development.

3.4Evaluation of the efficacy of the CMU Healthy Break by 3 experts in computer science and information technology, the researcher revised the program according to the expert recommendations until obtaining a program that is suitable for actual use.

3.5Promote and disseminate the use of the CMU Healthy Break through various channels such as social media and website, the researcher clarified the research objectives,ethical considerations,methods of using and evaluation of the program. Whenever participantshas read and accessed the program, it is considered consent by action and participation in the research process.

Data analysis

General information of the sample, the score for evaluating the use and satisfaction of the CMU Healthy Breakwere analyzed using descriptive statistics including frequency, mean and standard deviation.

Ethical Considerations

This study was conducted in accordance with the code of human research ethics and approved by The Ethical Review Committee for Human Research, Faculty of Public Health, Chiang Mai University (ET014/2020).

III. RESULTS

1. The CMU Healthy Break designing.

System analysis and system design are obtained by collecting information on user requirements or nutrition experts included: knowledge of healthy food and nutritive value, to analyze and design a database in a relational database format or functionality of the system, as shown in Figure 1.

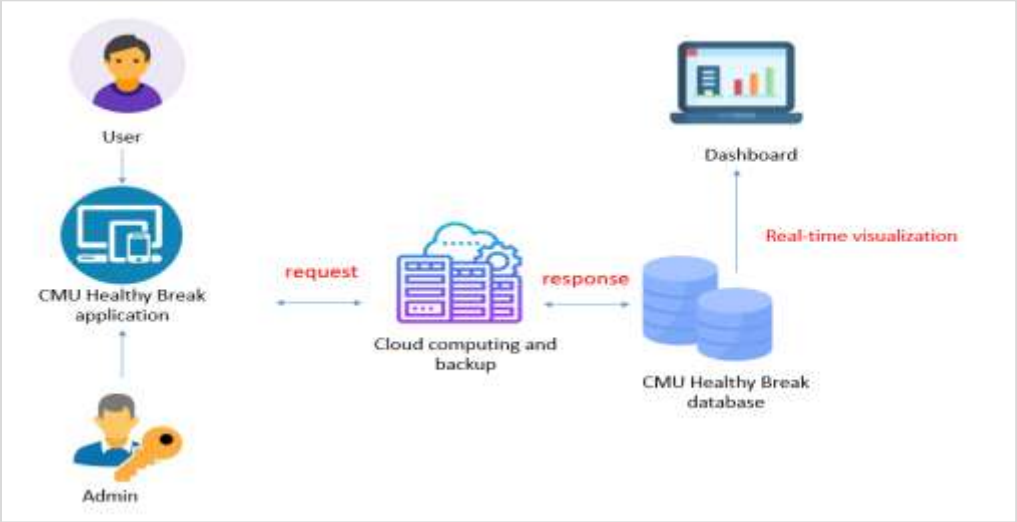

Figure 1: Overall Concept of CMU Healthy Break

The program is developed by using the System Development Life Cycle (SDLC). This application represented the results in a highquality system that obtained user expectations in nutrition, and reaches completion within time and cost evaluations and works effectively,as shown in Figure 2-4.

2. The results of the development of the CMU Healthy Break

The CMU Healthy Break has designed in display emphasizing the use of patterns and colors that are easy to read and contain interesting information support for use on communication devices. The system has 2 user groups: System Administrator, and each user group will be able to work with the system differently depending on the authentication as follows;

System Administrator is able to manage the system to be efficient, manage user information, manage snacks list, answering user questions, manage reporting and displaying.

General User is able to search for nutritional information of snacks by choosing the type of snacks and quantity consumed, the system will display the amount of nutrients consisting of total energy, sodium content, sugar content and fat content according to the selected quantity,as shown in Figure 5 - 7.

Figure 2: System Development Life Cycle (SDLC) model for system development(Rothi & Yen, 1989)

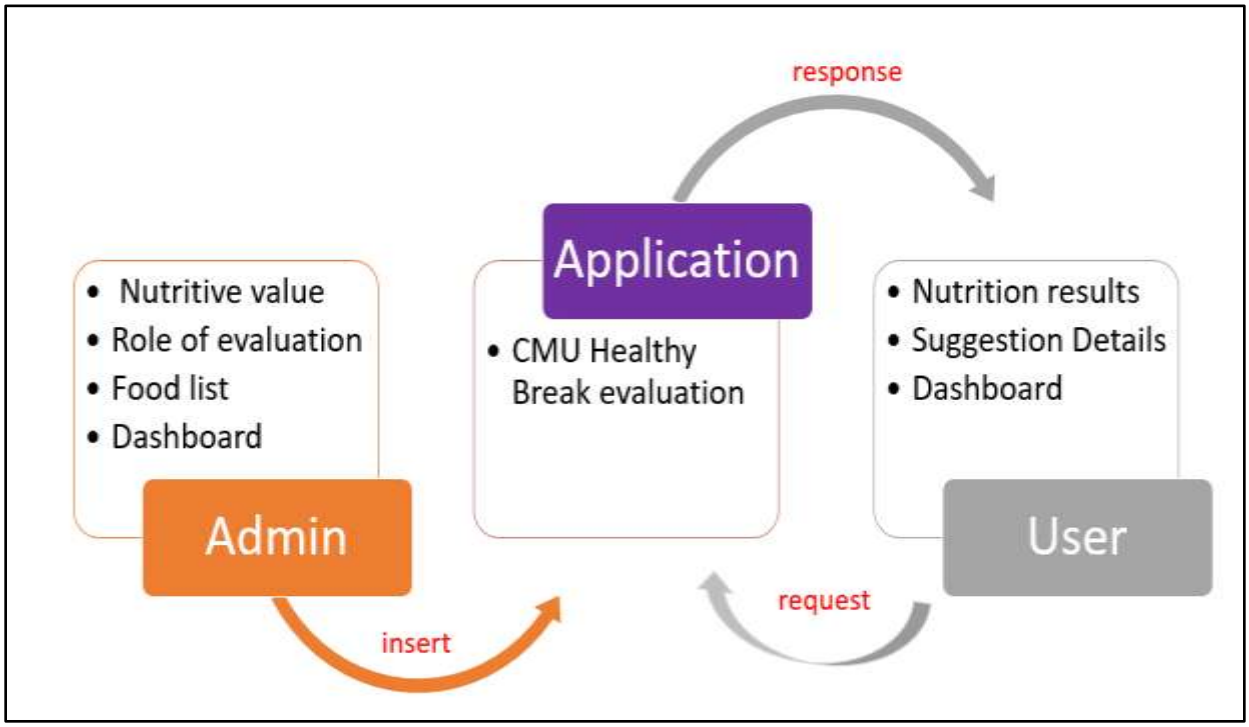

Figure 3: CMU Healthy Break workflow function.

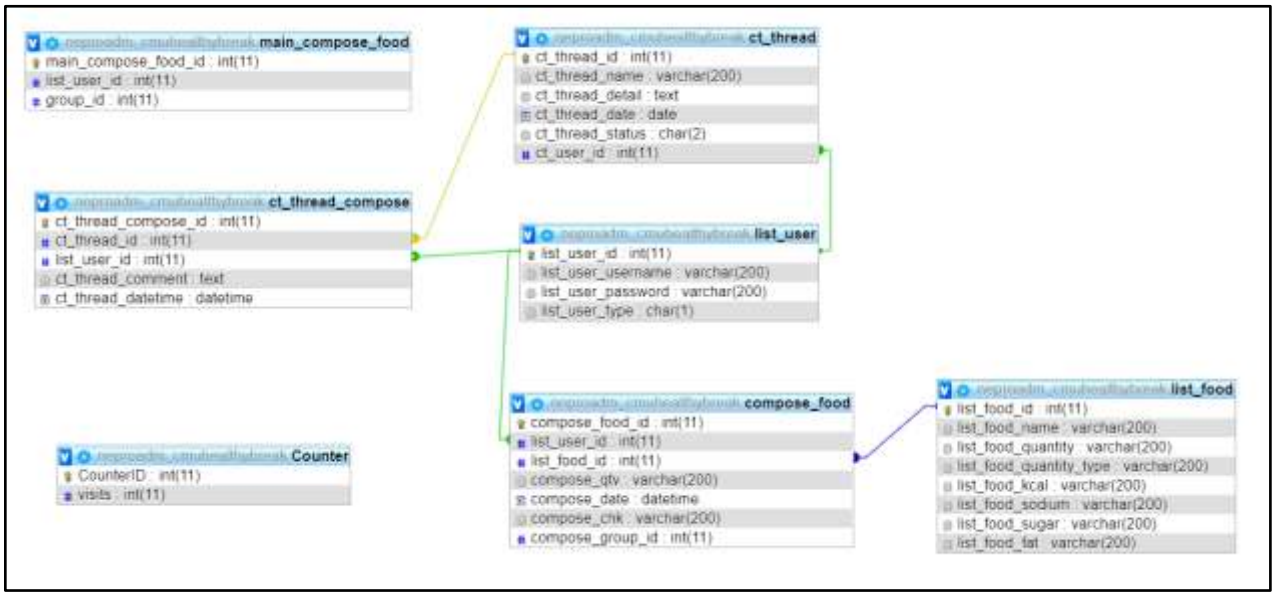

Figure 4: Database design (ER-Diagram)

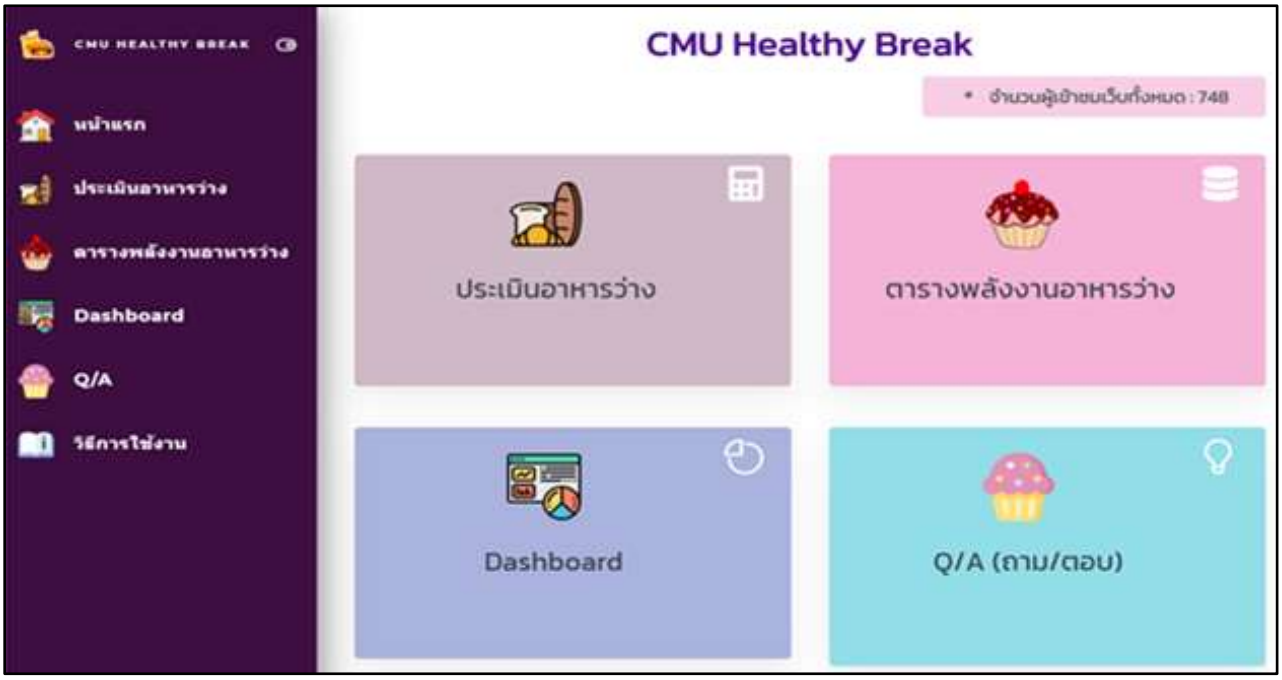

Figure 5: Main page of CMU Healthy Breakprogram

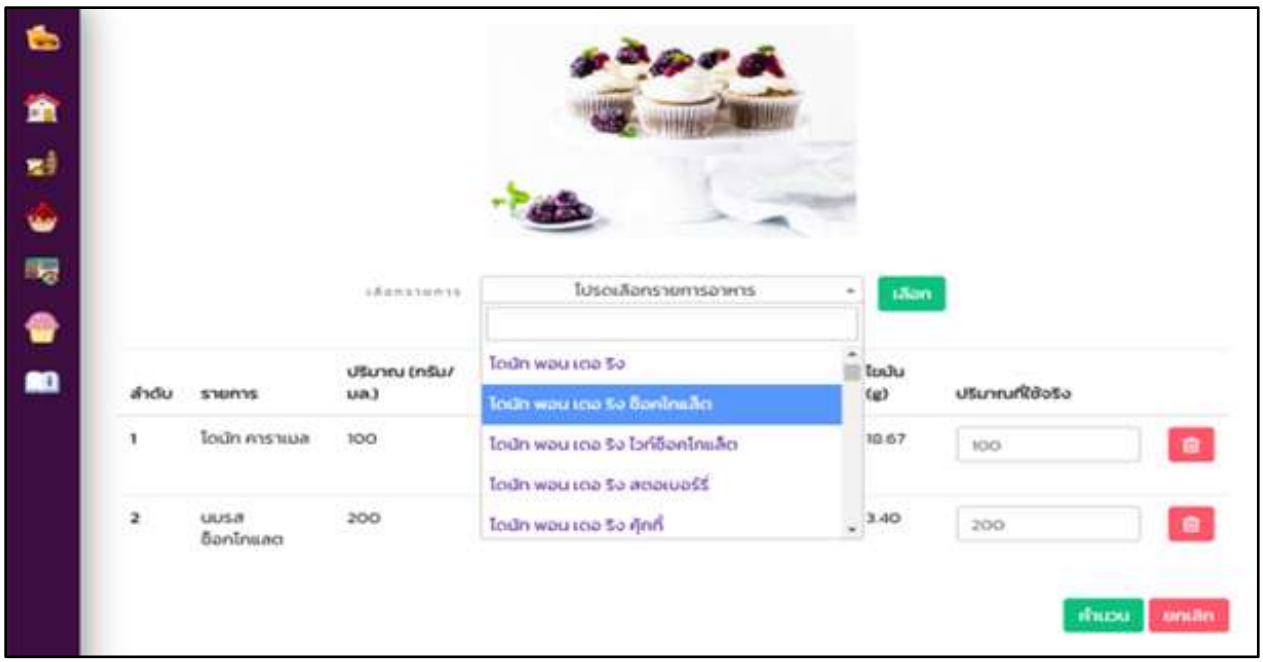

Figure 6: Example of snack evaluation

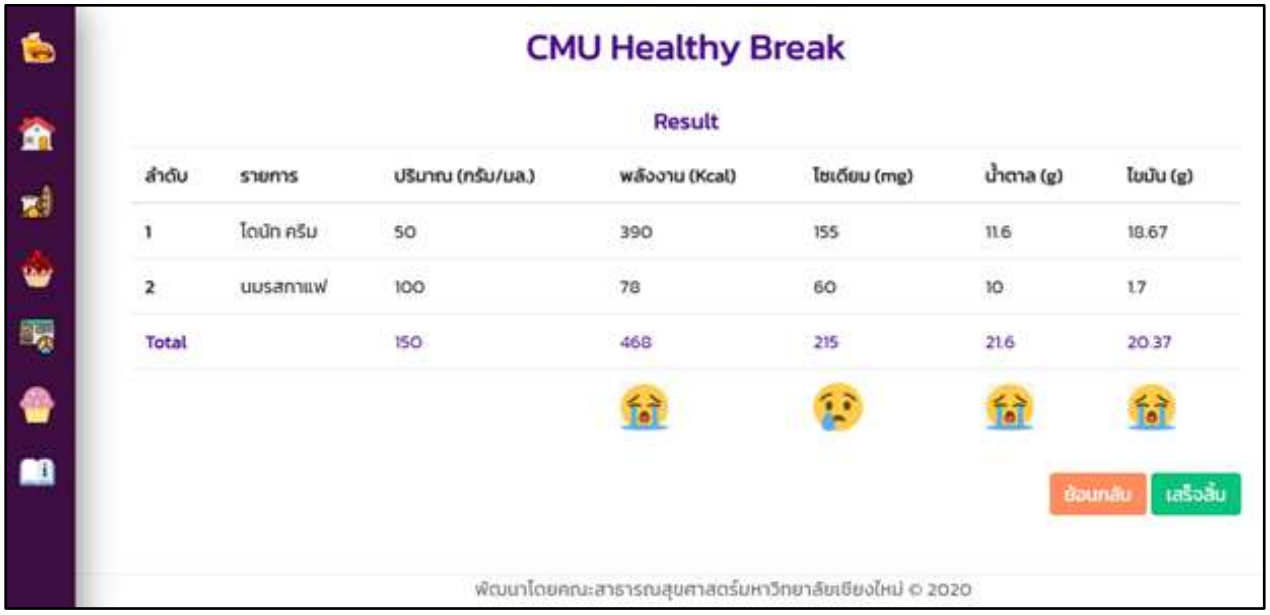

Figure 7: Results of CMU Healthy Break evaluation include total energy, sodium content, sugar content and fat content

In addition, in the reporting of results,the system will be explained to the user inan appropriate amount of nutrients that is suitable for consumption. There are recommendations for normal consumption,little consumption or refrain from consuming sucha kind of snack, as shown in Figure 8.

Figure 8: Suggestion of snack consumption

3. The evaluation of effectiveness of CMU Healthy Break

In evaluating the effectiveness of CMU Healthy Break, it was found that the content aspect had a mean score of 4.67 ± 0.34 (very good), design mean score of 4.31 ± 0.42 (good). Theperformance of the system mean score was 4.86 ± 0.27 (very good), and the usefulness of the program had a mean score of 4.75 ± 0.33 (very good), with the overall effectiveness score of 4.65 ± 0.38.This means that the developed system has a very good level effectiveness, as shown in Table 1.

Table 1:The effectiveness of CMU Healthy Break

Assessment issues	$\bar{x}$±SD	EffectivenessLevel
1. Content	4.67±0.34	Very good
2. Design	4.31±0.42	Good
3. Performance of the system	4.86±0.27	Very good
4. Usefulness of the program	4.75±0.33	Very good
Overall system effectiveness	**4.65±0.38**	**Very good**

4. The evaluation of the difficulty of CMU Healthy Break

The results of the evaluation of the difficulty of CMU Healthy Break by the user found that the operating procedures of the system had an average score of 1.67±0.41. The design was easy to use and the menu was simple.The average score was 1.53±0.32(easy level).The ease of use of the program had an average score of 1.74±0.37(easy level).The content was easy to understand, had an average score of 1.51±0.53(easy level) and the overall difficulty of the program had an average score of 1.61±0.48, indicating that the CMU Healthy Break was easy to use, as shown in Table 2.

Table 2:The difficulty of CMU Healthy Break

Difficulty Issue	$\bar{x}$±SD	Difficulty Level
1.The operating procedures of the	1.67±0.41	Easy

system		
2. The design was easy to use	1.53±0.32	Easy
3. The ease of use of the program	1.74±0.37	Easy
4. The content was easy to understand	1.51±0.53	Easy
The overall difficulty of the program	**1.61±0.48**	**Easy**

5. Satisfaction of CMU Healthy Break users

Overall satisfaction was the average of 4.74±0.57, indicating that the users had a high level of satisfaction when considering in each item, it was found that the first five issues that most users were satisfied with were the suitability of the program (4.87±0.64), followed by the ease of searching for the required information (4.85±0.62), the operation of the program is simple (4.81±0.36), the program has sufficient information to meet the requirements (4.77±0.70) and the clarity and purpose of the program (4.73±0.32), respectively, as shown in Table 3.

Table3:Satisfaction of CMU Healthy Break users

Satisfaction Issue	$\bar{x}$±SD	Satisfaction Level
1. The clarity and purpose of the program	4.73±0.32	High
2. The operation of the program is simple	4.81±0.36	High
3. The program can be used on both computers and smartphones.	4.66±0.63	High
4. The program has sufficient information to meet the requirements	4.77±0.70	High
5. The ease of searching for the required information	4.85±0.62	High
6. The information is accurate.	4.60±0.47	High
7. The suitability of the program	4.87±0.64	High
8. The program can be really useful in everyday life.	4.70±0.52	High
9. The questions and problems are answered by the system administrator.	4.63±0.67	High
Overall satisfaction	**4.74±0.57**	**High**

IV. DISCUSSION AND RECOMMENDATION

This research emphasizes on developing CMU Healthy Break, a computer program to analyze the nutritional value of snacks. In particular, it emphasizes the expression of nutrients including total energy, sugar, fat and salt content. These substances have the effects on health and the occurrence of chronic non-communicable diseases(Narisa et al., 2018). The CMU Healthy Break has applied information technology to nutrition knowledge to increase the efficiency and accuracy of the analysis,the CMU Healthy Break runs through the website. CMU Healthy Break is developed by using PHP language based on responsive web applications. This system has been connected to MySQL database and all data is backed up on cloud storage. Thesoftware usability testingwas conductedby the users to use the results to improve the CMU Healthy Break to suit and meet the needs of the users as possible.

CMU Healthy Breakhas developed greatly to shorten the time of searching for a snack list. This program has compiled a list of more than 500 popular snacks that Thai people eat, covering almost all snacks available in Thailand and does not contain the menu of main dishes.This makes it less time consuming to find

a snack item. It was also found that some snacks had different namesamong many programs that are currently in use to identify those snacks with only one name. Therefore, when users search for a different name, they cannot be found, so CMU Healthy Break solves the problem by the same food that has many names.The researcher will enter all those names while maintaining the same amount of nutrients. This gives the user a chance to find a list of snacks more easily. According to the user analysis, the use of CMU Healthy Break was based on the objective that the researcher had set in the first place that the user groups had both access to the program to help them eat their snacks and the other parts that use the program to help provide snacks at various activitiessuch as snacks in meetings or training seminars, etc. This program allows users to make better choices of snacks. There is reliable information in deciding whether or not to select that kind of snack. There are also comparisons to choose which other snacks are more appropriate.

However, CMU Healthy Break has some limitations that need to be further developed, including the amount of energy and individual nutrients depending on the quantity of raw materials and different methods of cooking. Therefore, the energy and nutrition of the snacks that appear in the software hence, is the average that has been compiled only from various data sources. This is a limitation found in today's programs for analyzing the nutritional value of foods (Chakkarin & Jitimon, 2011).In the future development of the CMU Healthy Break program, there should be more variety of snacks availableincluding adding a list of foreign snacks because many research reports suggest that the consumption behavior of Thai people has changed from the past with more popular for foreign food, especially Korean, Japanese, Chineseand western food(Teerawee, 2014).For ease of use, CMU Healthy Break program should be developed in the form of a smartphone application. Because it is a channel that many users can access and more convenient to use can be used anywhere and anytime there is an internet signal. In addition, the previous research found that many Thais of all ages are familiar with and prefer to use an application on their smartphones in finding information in various areas of daily life(Nuannapa, 2020).Therefore, the development of CMU Healthy Break in the form of a smartphone application is to make the general public access the program and make good use of it according to the lifestyles of the new generation who are focused on information technology(Nuannapa, 2020).Additionally, the researchers plan to develop CMU Healthy Break to display image of snacksto achieve clarity in communication because some snacks have very similar names, it can be confusing so image display is another solution to this problem(Ho et al., 2021; Sullivan, Bopp, Weaver, & Sullivan, 2016).To make the most of using CMU Healthy Break there will be an English version to be updated making it possible for foreigners to use it as well.

The CMU Healthy Break described herein makes available practical which is helpful in the day-to-day choosing of snacks for personal consumption and for various activities.Thus, snack choosing management by means of this software has the potential to facilitate the user decision-making process greater safety, accuracy, and efficiency.The software has not yet been tested on a large number ofusers in areas further than Chiang Mai Province, however, so forecasts about whether the program will become well integrated in daily practice cannot yet be made. This will be the subject of a future paper.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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